2012

# Communicating while stimulated: the effects of sensory-processing sensitivity on behavior and relationships

Christopher Charles Gearhart
*Louisiana State University and Agricultural and Mechanical College*, cgearh1@lsu.edu

# COMMUNICATING WHILE STIMULATED: THE EFFECTS OF SENSORY-PROCESSING SENSITIVITY ON BEHAVIOR AND RELATIONSHIPS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Communication Studies

by
Christopher Charles Gearhart
B.A., University of North Texas, 2003
M.A., San Diego State University, 2006
May 2012

## DEDICATION

I would like to dedicate this dissertation and the work that I do to all those family and friends who provided support, showed patience, and helped give me confidence over the years. Were it not for your love and guidance I would not be where I am today.

## ACKNOWLEDGEMENTS

I would like to acknowledge the individuals who provided direct support toward the completion of this dissertation. First and foremost I must thank my mentor and advisor Graham Bodie for showing me the dedication and persistence necessary to be a productive scholar capable of producing quality work. Next, I would like to thank the members of my committee, in alphabetical order of last name: Dr. Jim Garand, Dr. Frank Gresham, Dr. Jim Honeycutt, and Dr. Loretta Pecchioni. I would also like to thank the administrators at LSU including Dr. Renee Edwards and Dr. Andy King, as well as the incredible CMST support staff, most notably the multi-talented Lisa Landry, Ginger Conrad, and Donna Sparks.

Data collection was assisted by a number of student workers, in alphabetical order of last name, John Matthew Adamo, Tyler Carlos, Elizabeth Gallagher, Rachel Hill, and Simone Laroussini. I would also like to thank my colleagues and great friends, Shaughan Keaton and Andrea Vickery, who shared research lab time (and sometimes participants!) with me.

My time in Louisiana would not be the same without my hospitable, generous, and entertaining next door neighbors, the Chustz family. Paul, Lisa, Dillon, Kelli, and Jackie Boy all made me feel right at home from the first gusts of Hurricane Gustav to the last line in this dissertation. I am truly blessed to find a family of friends unlike any other.

Saving the most important for last, I must acknowledge my beautiful dog, Madison. The Mad-Dog. MD 20/20. Maddie Annie. Maddie Mae, and all her other nicknames from friends across the United States. We probably walked around the block 1000 times since we moved to Louisiana, but for her every time is like it's the first. Her happiness brings me joy and energy, and her love gives me stability and security. She is truly and forever this man's best friend. "I love you, have a good day. I'll be back later, I'll miss you"

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## ABSTRACT

In light of claims made by Aron (1996, 2000; Aron & Aron, 1997), this dissertation tested the influence of sensory-processing sensitivity on communication via two sets of research questions. First, are highly sensitive persons more easily aroused by stimulation, and if so does this necessarily cause a decrease in affect recognition? Results of an experimental study ($N$ = 342) indicate that highly sensitive persons (HSPs) were more distracted by audio stimulation, causing more errors in accuracy judgments on non-verbal decoding tests, most noticeably for facial expression detection. The implication is that, when aroused by stimulation in their environment, HSPs may be less interpersonally sensitive.

The question concerned with claims about highly sensitive men in relationships and their supposed "feminine" nature (Aron, 2000). Thus, it is asked, Are highly sensitive men (HSM) in romantic relationships, as compared to non-sensitive men, more expressive of their emotions and more understanding of partners, qualities which supposedly create greater gender role stress because they do not meet American norms for masculinity? Results demonstrate that HSM reported are expressive of negative emotions (e.g., being bothered) and experience greater gender role stress, qualities which may lead partners of HSM to report lower satisfaction. The implication is that if HSM are more easily bothered and more emotionally reactive, then they are more expressive of negative feelings, a quality which is detrimental for relationships if these complaints are viewed as criticisms (Gottman, 1990).

Overall, the studies suggest the communication behaviors of HSPs are influenced in mostly negative ways because of low thresholds for stimulation. Importantly, though, effects were generally small and hard to detect in the sample sizes reported here, and the current measure of SPS seems to be inappropriate for measuring the complete conceptual breadth of the

construct. A number of intrapersonal, individual, and interpersonal directions for future research are suggested.

# CHAPTER ONE

# INTRODUCTION

Growing up, I remember being struck by my father's abilities to smell roses 10 yards away, taste every subtle flavor in an exotic plate of food, and notice sounds like birds singing in the distance that were virtually undetectable to the normal listener. Socially, he makes favorable first impressions, is outgoing and active, and loves to tell bad jokes (both types). Do these traits make my father superhuman? As a boy I thought so, but I have come to realize that my father is human after all, albeit an unusual breed of highly-sensitive person - one who is extroverted and also has increased sensory-processing capabilities (Aron, 1996; Aron & Aron, 1997).[1] Perhaps his humanity is no more evident than in his inability to watch violent films or TV shows; he also is easily startled by noises and highly distracted by strong odors (e.g., cigarette smoke), and he becomes unusually uncomfortable when he is overstimulated by bright lights and chaotic scenes. In general, the positive outcomes bestowed upon highly-sensitive people like my father are tempered by a tendency to become overaroused which results in behavioral consequences such as avoiding stimulating people or situations (e.g., Aron, 1996).

Though it was not until recently that I realized the possibility that characteristics of the highly sensitive may influence communication behaviors, I attribute an initial interest in the topic to my association with a family of them. The fact that several of my family members (as well as myself) exhibit signs of high sensory-processing sensitivity led me to the writings of Elaine Aron who recently defined sensory-processing sensitivity (SPS) as "sensitivity to both internal and external stimuli, including social and emotional cues" (Aron et al., 2010, p. 220). As the example of my father illustrates, and as the academic literature (Aron & Aron, 1997; Aron, Aron,

[1] Aron (1996) suggests that approximately 30% of highly sensitive persons are extraverted.

& Jagiellowicz, in press) suggests, increased sensory-processing has both positive and negative consequences; when it comes to social interaction and relationships, high sensitivity is both a blessing and a curse. Accordingly, this dissertation proceeds with the following general research question in mind: What are the positive and negative impacts of sensory-processing on communication behaviors, abilities, and choices for the individual and relationships?

In order to provide a context to answer such a broad question, this introductory chapter will first define SPS and briefly explain how this trait may be related to communicative abilities, behaviors, and choices. Following a short discussion of this project's primary contribution, a short preview will outline the components of this dissertation that attempt to answer the primary question posed above.

**Sensory-Processing Sensitivity**

Sensory-processing sensitivity is an inherited neurological trait that predisposes an individual to become hyper-aware of and/or overwhelmed by his or her social and physical environment (Aron et al., in press). It is *not* a difference in the abilities of sensory organs themselves, which is to say that highly sensitive persons do not have eagle eyesight, a hound-like sense of smell, and bat-like hearing. Rather, SPS is a neurological difference in how people cognitively *process* stimuli in their environments. To wit, higher self-report scores on a measure of SPS have been associated with greater neurological activity and functioning, as measured via functional magnetic resonance imaging (Jagiellowicz et al., 2011). Specifically, functional magnetic resonance imaging (fMRI) recordings of brain activity demonstrate that highly sensitive persons (HSPs) process subtle changes in landscape images for longer durations and at higher intensities.

With respect to social consequences, another fMRI study found that SPS correlated with greater brain activation in areas associated with empathy when participants were shown photos of both happy and sad faces compared with neutral faces (Acevedo, Aron, & Aron, 2010), which may provide evidence to explain the finding that HSPs report higher levels of empathic concern (Gearhart, 2011). Like the study on empathy, self-report research studies have identified moderate to strong relationships between sensory-processing and other communication concepts such as communication adaptability (Glonek, Nash, Shields, Sawyer, & Behnke, 2007) and communication apprehension (Gearhart & Bodie, 2012; Garland & Haas, 2011).[2] Thus, studies have identified both positive and negative consequences for communication.

Given the aforementioned findings, possible relational consequences such as a fewer opportunities to meet relational partners, a decrease in shared activities with actual partners, higher levels of empathy and understanding, and a tendency to withdrawal from discussion when aroused by averse or intense stimulation may be attributable to increased SPS (Aron, 1996, 2000). These communicative consequences mark SPS as an important site for studying communication, thus it is the aim of this dissertation to examine the intriguing possibility that these types of communication outcomes may be related to SPS, a biological trait. The influence of biology on communication is certainly not a new idea or concept, and evidence exists to demonstrate that some communication-oriented traits are heritable (see Boren & Veksler, 2011).

The paradigm of communibiology (Beatty & McCroskey, 1997; Beatty, McCroskey, & Heisel, 1998) is particularly concerned with identifying biological and neurological antecedents for human communication behavior. Studies in the paradigm of communibiology, however, have been criticized on grounds that few investigations have been directed toward understanding the role that *specific* genetic structures, hormonal imbalances, and/or neurological structures play

[2] Both communication apprehension and adaptability have been explained by biological antecedents.

in determining communicative behavior (Nelson, 2004). This research responds to this critique and adds a concept of study to the communibiology literature that is already established in neuroscience journals.

**Project Importance**

Seeing that Aron admits on her website, www.hsperson.com, to selling more than a million copies world-wide of her influential book, *The Highly Sensitive Person* (1996), it is important that her claims be supported with peer-reviewed qualitative or quantitative evidence. Similar to other self-help books and authors that produce works with unfounded and/or bogus claims (e.g., see Goldsmith & Fulfs, 1999, "You just don't have the evidence" for an extended discussion of similar problems), those of Aron are harmful because they provide readers with claims that may be contradictory to actual solutions. Along with her initial 1996 bestseller, several other books have been written about the impacts of SPS on relationships (e.g., Romantic relationships: Aron, 2000; parent-child relationships: Aron, 2002). Unfortunately, these books offer advice that is based upon a few anecdotes rather than a collection of peer-reviewed publications regarding the influence of SPS in relationships.

For example, one of the primary claims in the initial book (Aron, 1996) was that HSPs are more bothered by stimulation which causes them to perform worse in a number of social and cognitive areas. Specifically, Aron (1996) states "what is moderately arousing for most people is highly arousing for HSPs. What is highly arousing for most people causes an HSP to become very frazzled until they reach a shutdown point" (p. 7). To date, however, no direct evidence to support this claim about HSPs has been provided. In a more blatant example, Aron (2000) claims that highly sensitive men are more feminine because they fail to meet societal expectations for masculinity. Aron (2000) states, as a matter of fact, that by the American

societal standards of masculinity, "a highly sensitive man is not a 'real man'" (p. 50) given their propensity to be more expressive of their feelings and understanding of the emotions of others. As an HSM myself, these are alarming and controversial claims for which no empirical evidence was provided.

Although many of her claims remain questionable, Aron is correct to acknowledge that the impact of SPS on communication has profound theoretical and practical potential. Theoretically, scholars may be able to make more accurate predictions of human behavior based upon an understanding of the association between communication skills and SPS. As such, theoretical models or a set of propositions describing relationships among sensitivity, communication skills, dispositions, and outcomes should be established. This is important in order to illustrate the complex association between biological makeup and communication behaviors in that behaviors are a function of neurological processing abilities. In addition to theoretical contributions, the results of this dissertation also have pragmatic implications for the target population of study: college students. College students who experience high SPS may be at a greater risk for developing negative relational and conflict management behaviors such as withdrawal, experiencing decreased cognitive performance, and have fewer quality social relationships than non-sensitive students (Gearhart & Bodie, 2012).

Ultimately, investigating the role of a particular endogenous neurobiological trait like SPS will help scholars to better understand a potentially universal influence on individuals' communicative abilities and choices. Focusing on temperament traits related to neurological processing relocates the study of communication to an internal site of study that exists in all people (i.e., the brain) and allows for a much broader explanation of human communication behavior encompassing skills, predispositions, and choices.

**Project Goals**

The overall purpose of this dissertation is to determine the positive and negative influences of SPS on interpersonal relationships and communication. In order to accomplish this goal, an experimental study will first examine the influence of SPS on college students' non-verbal decoding abilities (or inferential ability). Individual differences in sensitivity have been assumed to lead to increased discriminatory ability which may be responsible for either increased social information processing abilities (Rothbart, Ahadi, & Evans, 2000). For example, inferential ability (Hall, Andrzejewski, & Yopchick, 2009) is the ability to notice and accurately interpret the emotional cues of others as such HSPs are considered to be more accurate because of greater discriminatory ability. This study thus contributes to the larger body of literature on interpersonal sensitivity (Bernieri, 2001) by providing a possible explanation for its source, which is important because accurately assessing cues is a precursor responding appropriately (Hall et al., 2009). However, because overstimulation is believed to be a crucial moderating variable that is negatively related to a highly sensitive person's social abilities (Aron & Aron, 1997), students will be exposed to aversive stimulation to determine the potential for decoding deficits. Findings relevant to this latter point contribute primarily to literature on deficits in information processing, which encompasses related constructs such as receiver apprehension (Wheless, 1975) and Gottman's (1990) Diffuse Physiological Arousal theory.

Next, a self-report study will examine differences in managing affect and relational satisfaction between partners of sensitive and non-sensitive men. This study will test whether HSM are better relational partners because of increased interpersonal sensitivity, a claim in Aron's *Highly Sensitive Persons in Love* thesis (2000). Using a model of gender strain

forwarded by Pleck (1995), the self-report study aims to provide support for or against undocumented claims of Aron (2000) regarding HSM as more "feminine".

In order to provide a necessary rationale for the goals of this dissertation, Chapter Two presents a theoretical model of the influence of SPS on communication that integrates other tertiary perspectives and forwards a series of testable propositions. The chapter begins by introducing the concept of sensory-processing sensitivity as well as presenting a selected number of studies regarding the interplay of SPS and communication. Chapters Three and Four present the results of the experimental and the self-report study, respectively. Chapter Five offers a general discussion of the findings in light of the goals stated in Chapter Two, including limitations and directions for future research regarding the influence SPS on communication.

# CHAPTER TWO

# REVIEW OF LITERATURE

The purpose of this chapter is to describe the concept of sensory-processing sensitivity (Aron & Aron, 1997), explicate its potential influences on individual and relational outcomes, and posit fifteen propositions regarding the impact of four specific characteristics of trait SPS on communication and relationships. To establish a paradigmatic framework, a discussion of previous findings relating SPS to communication abilities will situate this project in the literature of communibiology (Beatty & McCroskey, 1997; Beatty, McCroskey, & Heisel, 1998). Next, the influence of sensory-processing sensitivity (SPS) on communication will be considered and presented from both the individual and relational perspectives. This chapter begins by defining sensory-processing sensitivity (SPS) (Aron & Aron, 1997) and then presents research relevant to its measurement, biological characteristics, and location in the brain.

## Sensory-Processing Sensitivity Conceptualization

"In everyday language, sensitivity can refer to neuroticism/negative emotionality ('Don't be so sensitive.'), sensitivity concerning the needs of others, sensitivity related to imagination, aesthetics, and the arts, and general sensory sensitivity" (Evans & Rothbart, 2008, p. 109). Thus, trait SPS is more than simply "sensitivity to stimulation", and the conceptual breadth of the trait has led to the description of SPS as more sensitive *processing* of sensory data rather than more perceptive sensitive sensory organs (Aron, 1996, p. 12). More specifically, SPS is "a genetically determined trait involving a deeper cognitive processing of stimuli that is driven by higher emotional reactivity" (Aron, Aron, & Jagiellowicz, in press, p. 1). This definition highlights two features of SPS: a tendency to process stimuli more deeply and a higher level of arousability.

Derivations and expansions of these two features have been explicitly noted in the four theoretical facets of sensitivity: (a) inhibition of behavior, at least in novel situations, in order to attend to potentially useful cues; (b) greater awareness of sensory stimulation, so that more subtleties are noted, but overstimulation is also possible; (c) deeper processing of sensory information, relating it to the past and projecting its consequences into the future; and (d) stronger emotional reactions (Aron, et al., in press, p. 6). Each of these characteristics stems from the biological qualities of SPS.

**Biological Qualities of SPS**

SPS is a trait that is conceptually similar to other previously studied arousability constructs such as general temperament (Thomas & Chess, 1977), reactivity or responsivity (Mehrabain, 1976), and inhibitedness (Kagan, 1994). What makes SPS unique is the focus on sensory *processing* such that difference in cognitive functionality is a central feature (Aron & Aron, 1997). The trait has been largely discussed in dichotomous terms (ie., highly sensitive persons vs. non-highly sensitive persons) with those persons exhibiting higher levels of sensitivity being labeled as highly sensitive persons (HSPs; vs. non-HSPs). SPS is claimed to be a genetically inherited trait which is evident in approximately 15-35% of the population (Aron, et al., in press); however the exact percentage or number of HSPs remains uncertain.

Persons are designated as highly sensitive according to their scores on a self-report measure of sensory-processing sensitivity, the Highly Sensitive Persons Scale (HSPS; Aron & Aron, 1997). Although the details of the development of the HSPS are available elsewhere (e.g., Aron & Aron, 1997; Aron et al., in press) and are discussed at length later in this dissertation, a brief overview is necessary since it is the sole operationalization to date. First, authors recruited people who were "easily overwhelmed by stimuli (such as noisy places or evocative or shocking

entertainment)" (Aron et al., in press, p. 11) to participate in three-hour interviews about their sensitivity attributes. From these interviews, a 60-item questionnaire was created, which ranged far beyond being easily overwhelmed by stimulation. After narrowing the initial pool of items to a 27-item scale, the instrument was tested over six samples (involving 604 undergraduate psychology students at different universities and a community sample of 301 obtained using random digit dialing), in which alphas ranged from .64 to .75. The authors concluded that the HSPS operationalized a construct distinct from neuroticism and introversion, and provided correlations between these personality traits and SPS as evidence of construct validity (Aron & Aron, 1997). The measure has been used to distinguish between brain activation patterns of HSPs and non-HSPs, suggesting possible internal sites for SPS (Jagiellowicz et al., 2011).

Nevertheless, the exact, precise biological foundation of SPS still remains in question as researchers have only preliminarily determined a neurological source of the action of processing sensitivity. Although a brief overview of the suggested biological origins as well as recent neurological evidence of this trait is presented to provide a background for understanding the functionality and general neurological location of sensory-processing sensitivity, information regarding the nature of SPS and studies detailing specific biological processes can be found elsewhere (see Aron & Aron, 1997; Aron et al., in press, for full reviews).

Original authors of the trait were hesitant to make predictions about specific regions of the brain, but it was speculated that it "is the activity of the frontal cortex that no doubt contributes most to the characteristically more subtle processing … as well as perhaps a greater consciousness of self and environment" (Aron & Aron, 1997, p. 349-350). E. N. Aron and Aron (1997) proposed Gray's (1982, 1991; Gray & McNaughton, 2000) behavioral inhibition system as a possible neurological structure related to trait SPS. The behavioral inhibition system (BIS)

is one neurological system that regulates the reception of sensory information in the brain with specific attention toward stimuli that are novel, threatening, or non-rewarding. In turn, the presence of these types of stimuli activates BIS functioning, ultimately inhibiting cognitive processes and behavior and causing feelings of anxiety and arousal. This is frequently referred to as the Fight or Flight state.

Consistent with this logic, a functional magnetic resonance imaging (fMRI) study identified differences in the activation patterns of specific brain regions between highly sensitive persons and non-sensitive persons. Individuals who varied in their scores on the HSPS (Highly Sensitive Persons Scale; Aron & Aron, 1997) completed a change detection task in an fMRI scanner whereby subjects viewed two landscape images presented in quick succession and determined if the images were similar or different. Authors concluded that their results "support a relationship between SPS and both increased response time and increased brain activation in relevant regions in response to subtle changes in stimuli", and that trait "SPS makes a unique contribution to individual differences in brain response" (Jagiellowicz et al., 2011, p. 46-47). Greater activation during the subtle-change tasks appeared in a variety of regions, especially those associated with visual attention. These regions include the right claustrum, left occipitotemporal, bilateral temporal, and medial and posterior parietal regions as well as the right cerebellum, all of which have been implicated in cognitive processes related to comparing incoming visual stimuli with information stored in the brain (Kanwisher, Woods, Iacoboni, & Mazziotta, 1997). Essentially, HSPs posses are greater depth of discrimination in that they process subtle differences more "deeply".

Evidence of observable brain differences between HSPs and non-HSPs is the most recent form of support for trait SPS. Validity studies have previously provided evidence that SPS is

related to temperament traits and personality constructs to which it is theoretically and conceptually similar, such as introversion, neuroticism, and BIS/BAS functioning (Aron & Aron, 1997; Smolewska, McCabe, & Woody, 2006). Furthermore, scholars also have identified relationships between SPS and biologically-rooted communication constructs like communication apprehension (Gearhart & Bodie, 2012) and communication adaptability (Glonek et al., 2007).

**Construct Validity**

Temperament traits like SPS are considered bases of personality and behavior because they are rooted in biological and neurological structures (McCrae et al., 2000; Sterlau, 1987). Indeed, empirical studies provide evidence that SPS is related to temperament features and thusly to personality traits. Subsequent examinations of self-report data identified a positive, moderate relationship, $r = .32$, between SPS and temperament as measured by BIS scores, and regression analysis identified BIS scores as a significant predictor of self-perceived SPS (Smolewska et al., 2006). In particular, high BIS activity is associated with SPS, and BAS functioning was largely unrelated, as proposed by Aron and Aron (1997) in their original conceptualization. Motivation to behave in a cautious manner in order to prevent negative consequences and unpleasant states (BIS reactivity) appears to have the clearest link with SPS. Further, the fun-seeking subscale of BAS reactivity was negatively related to SPS, reflecting Aron et al.'s (in press) notion that HSPs are low sensation-seekers.

Temperament traits like SPS and BIS reactivity are manifested in differences in sociability and emotionality, prominent personality characteristics (McCrae et al., 2000). In its conceptualization, SPS was found to be "related to but not identical with" (Aron & Aron, 1997, p. 361) well-researched personality dimensions of introversion (a lack of extraversion) and

neuroticism (higher negative emotionality).[1] Subsequent investigations have identified correlations between SPS and measures of "Big Five" personality characteristics at the magnitude of $r$ = .45 (neuroticism) and $r$ = -.09 (extraversion) (Smolewska et al., 2006). As is evident, findings indicate more modest evidence for the influence of SPS on introversion. Over a series of seven studies by Aron and Aron (1997), the median correlation between a measure of SPS and measures of introversion was .29. The differences in personality evidenced in these studies lend credence to the notion that the temperament quality of trait SPS has behavioral consequences. However, it is also important to understand how SPS may serve as a force for or cause of individual differences in human communication behavior.

## Link to Communication

The belief that biological traits can influence communication is not a new idea. The communibiology paradigm (Beatty & McCroskey, 1997; Beatty et al., 1998) assumes that human biology is the primary determinant for many communicative abilities and behaviors, and in order to best understand differences in human communicative behavior it is imperative to study links between behavior and biology. Beatty, McCroskey, and Pence (2009) explicated the four major premises for communibiology (pp. 5-12):

> Premise 1: All mental processes involved in social interaction are reducible to brain activity.
>
> Premise 2: Communicator traits and temperament characteristics represent individual differences in neurobiological functioning.
>
> Premise 3: Individual differences in the neurobiological systems underlying communicator traits are principally (but not completely) inherited.

[1] Personality features attributed to SPS have also been suggested to be moderated by childhood experiences, and the authors have emphasized that, in combination with a poor childhood environment, higher SPS results in predominately negative affect or higher levels of neuroticism (while sensitive persons with positive childhood experiences appear to have better outcomes on many measures).

> Premise 4: Dimensions of situations have only negligible direct effects on behavior.

These premises, that all communicator traits are products of neurological functioning, provides rationale for the belief that, as an individual difference in neurological functioning, SPS may be partially responsible for behavior. This dissertation does acknowledge, and the authors of the original SPS construct would contend, that situational influence (e.g., childhood experiences) plays a partial (and potentially consequential) role in combination with biological predispositions (e.g., temperament) which are the roots for behavior (Sterlau, 1987). Indeed, other communibiology scholars have questioned the strong assertion of premise four on grounds that it "may inadvertently deny how sensory information drawn from interpersonal interaction has effects on the nervous system and becomes a part of a larger communication process" (Boren & Veksler, 2011, p. 3). However, the concession of premise four does not necessarily or inherently diminish the probative value of this or any other communication research that assumes a biological perspective as at least a contributing factor (Kirzinger, Weber, & Johnson, 2012).

Other critiques of the paradigm are that communibiology writings are curious for their reliance on paper and pencil self-reports of bodily states, sentiments, and behavior (Babrow, 2005; Nelson, 2004). Although this criticism came earlier, recently Boren and Veksler (2011), in a meta-analysis of communibiological work, identified over 95 physiological studies related to communication over the last ten years in the top 20 communication journals. This fact also highlights the second critique of communibiology, that the paradigm has relied solely upon communication journals and commercial press series in communication as outlets for literature (Nelson, 2004). As a paradigm that is rooted in biology, specifically neurobiology, and given the strong assertions of premise one and two, the lack of studies in social cognitive neuroscience

journals is unflattering (Babrow, 2005). Given that SPS has a limited amount of evidentiary support in the neuroscience vein (e.g., Acevedo, Aron, & Aron, 2010; Jagiellowicz et al., 2011), this dissertation adds a compelling branch of literature to the communibiology paradigm, one that purports brain structures are bases for behavior.

To date, the largest gains from communibiology are the oft cited self-report studies which have documented the influence of biology on specific communication constructs such as verbal aggressiveness (Beatty & McCroskey, 1997; Valencic, Beatty, Rudd, Dobos, & Heisel, 1998), communicator style (Horvath, 1995), communication apprehension (Beatty et al., 1998; McCroskey & Beatty, 1998), and retrospective evidence from research on twins, whichhas investigated the heritability of constructs similar to communication adaptability (Beatty, Marshall, & Rudd, 2001). These last two findings are important because SPS is related to communication constructs previously identified as having biological origins, such as communication apprehension (CA) (Gearhart & Bodie, 2012) and communication adaptability (Glonek et al., 2007). Comparatively, the link between CA and SPS has been explicated in greater detail.

The tendency to experience anxiety when communicating or thinking about communicating with others – CA (McCroskey, 1977) – is considered, to some extent, to be a function of "genetically inherited thresholds for the activation of neurobiological systems" (Beatty et al., 1998, p. 201). Given that SPS and CA are conceptualized as having biological origins and arousal thresholds, the link between SPS and communication apprehension is apparent. Chiefly, SPS is considered an inherited trait responsible for one's threshold for stimulation (Aron & Aron, 1997); the origin of CA is likewise believed to be the result of "genetically inherited thresholds for the activation of neurobiological systems" (Beatty et al.,

2008, p. 201). Furthermore, the relations both SPS and CA share with well-researched, highly agreed upon personality characteristics -- such as neuroticism and introversion -- provide support for a possible association between the two (see Aron & Aron, 1997; Beatty et al., 1998). If SPS is a trait present at birth that characterizes persons with hyper-active neurobiological systems, as claimed by Aron and Aron (1997), and CA truly is a consequence of genetically inherited thresholds for neurobiological stimulation, then CA should be related to SPS. Indeed, Gearhart and Bodie (2012) have identified a positive relationship between SPS and CA, which seems to indicate some support that SPS, a biological trait, can influence communication.

## Implications for Communication

To this point it has been proposed that, in general, the genetic, in-born primacy of SPS has consequences for the individual that can extend into the social realm as suggested by the conceptual and empirical overlaps with CA reviewed above. Since temperament is fundamental to explaining personality types (McCrae et al., 2000; Sterlau, 1987), and because SPS is a temperament trait found to contribute to differences in personality (Aron & Aron, 1997; Smolewska et al., 2006) and social behavior (Gearhart, 2011; Gearhart & Bodie, 2012), other potential outcomes should be considered. Thus, four aspects of SPS (Aron et al., in press, p. 6) -- inhibition of behavior (e.g., less sociability), greater awareness of sensory stimulation (e.g., lower threshold for activation of processing), deeper processing of sensory information (e.g., longer processing times and higher intensities), and, stronger emotional reactions (e.g., high responsivity to cues and emotions) -- are examined for their likely effect on communication abilities and behaviors. Research on each of these aspects suggests a set of propositions exploring theoretical relations between SPS and communication outcomes. These propositions are listed in Table 2.1 and constitute the core theory of SPS and communication.

Table 2.1: Propositions concerning SPS and communication outcomes

| | |
|---|---|
| Proposition 1 | If HSPs are more prone to "pause and check" which inhibits behavior, then they will experience greater stress and anxiety in social situations. |
| Proposition 2 | If sensitivity to stimuli causes HSPs to experience greater sensory discomfort, then HSPs will be less able to process social information. |
| Proposition 3 | If HSPs are more self-aware, then they are expressive of their feelings. |
| Proposition 4 | If HSPs are more self-aware, then they will more often experience intrapersonal social cognitions. |
| Proposition 5 | If HSPs process non-verbal facial and vocal cues of social actors more intently, then they are more accurate at inferring true emotional states. |
| Proposition 6 | If deeper processing contributes to cognitive backlog, then exposure to multiple or intense stimuli will cause HSPs to perform more poorly during cognitive processing tasks. |
| Proposition 7 | If HSPs are more emotionally reactive, then they will be more responsive to the feedback of others. |
| Proposition 8 | If HSPs are more emotionally reactive, they experience greater levels of stress. |
| Proposition 9 | If HSPs avoid arousing activities, then HSP relationships may be at risk of becoming unexciting and of low quality. |
| Proposition 10 | If highly sensitive partners are aware of others' feelings, then they should experience more understanding in their relationships |
| Proposition 11 | If HSPs are more prone to experience sensory discomfort, then they avoid engaging in highly stimulation activities with relational partners. |
| Proposition 12 | If HSPs more deeply process the messages of others, then relational partners should report more feelings of being listened to and understood. |
| Proposition 13 | If more empathy is conveyed by HSPs, then they should experience greater relational satisfaction. |
| Proposition 14 | If HSPs are more emotionally reactive, then they withdraw from conflict situations. |
| Proposition 15 | If HSPs experience greater levels of emotional reactivity, then heightened feelings of sympathy exist. |

## Consequences for the Individual

Behavioral outcomes such as decreased sociability, increased awareness of self and responsitivity to the environment, an ability to discriminate between fine changes in vocal or facial expressions of emotion (e.g., vocal stress or micro-momentary expressions, respectively), and greater emotional reactivity to the messages of others are all considered to be related to higher SPS.

**Inhibition of Behavior.** First and foremost, inhibited behavior resultant from trait SPS is reflected in personality differences such as introversion. Behavioral inhibition occurs because HSPs take time to observe environmental cues rather than ignore them (Aron et al., in press, p. 7). When HSPs encounter a new or stimulating environment, they unconsciously process and monitor their surroundings and are left unable to attend to other cues or action plans during processing. This tendency to "stop and check" (Aron & Aron, 1997) is believed to be the source of an introverted personality because HSPs are unable to perform socially whilst processing and tend to hesitate when choosing to enter such situations.[2]

A possible source of the link between introversion and SPS is the tendency for HSPs to experience a greater "ease of excitation" when exposed to stimulation. Ease of excitation (EOE) is related to becoming mentally overwhelmed by external stimuli (e.g., Do you startle easily?) (Smolewska et al., 2006) and is associated with introversion. Regression analyses using the HSPS as a predictor of personality dimensions measured by the "Big Five" found that only items reflecting EOE were significant predictors of introversion (Ahadi & Basharpoor, 2010), results that are in line with other studies (e.g., Smolewska et al., 2006). The findings suggest that persons who are highly reactive to environmental stimuli tend to avoid high intensity sensory

[2] Although, it should be noted that Aron (1996) finds approximately 30% of HSPs to be extraverted, like my dad.

situations to such a degree that avoidance can limit social relations, reduce positive emotions, and lead to introversion (Ahadi & Basharpoor, 2010).

Other types of social inhibition conceptually similar to introversion also have been investigated as being influenced by SPS. For example, social anxiety (Hoffman & Bitran, 2007) and adult shyness (Aron, Aron, & Davies, 2005) have both shown relationships with SPS. Furthermore, as discussed earlier, communication apprehension (McCroskey, 1977) has been found related to SPS. Results from the study indicated a moderate, positive relationship, $r = .25$, between SPS and CA (Gearhart & Bodie, 2012). The noticeable increase in apprehension in the group, meeting, and public speaking situations was believed to be a result of anxiety from being evaluated by an audience larger than a dyad.[3] Indeed, items on the HSPS a person's tendency to become mentally overwhelmed due to the presence of a keen and watchful audience; thus, public performance ability becomes inhibited amongst the highly sensitive due to feelings of conspicuousness. As McCroskey (1984) noted, "Probably nothing can increase CA more than being conspicuous in one's environment … generally, the more conspicuous people feel, the more CA they are likely to experience" (p. 25). As HSPs are more aware of their surroundings, and the reactions of their audience, they become more apprehensive.

The studies reviewed above collectively suggest that SPS is related to the inhibition of communicative behavior. Generally speaking, sensory over-processing results in inhibited behavior and influences communication such that HSPs are less likely to engage in communication opportunities and are more likely to experience feelings of anxiety and/or arousal when thinking about communicating. Indeed, social stress in college is related to higher SPS (Gearhart & Bodie, 2012) suggesting that HSPs have more relationship troubles possibly because of their sensitivity. Whatever outcome variable is considered, be it social anxiety, adult shyness,

[3] There was no statistically significant relationship found between SPS and dyad apprehension.

introversion, or communication apprehension, the majority of highly sensitive persons are often less able or less willing to be outgoing communicators. Therefore, if HSPs are more prone to "pause and check" which inhibits behavior, then they will experience greater stress and anxiety in social situations (Proposition 1).

**Sensitivity to Stimuli.** Aron and Aron (1997) cast their sensitivity to stimuli feature of SPS as having two separate properties, and studies (Evans & Rothbart, 2008; Gearhart & Bodie, 2012; Smolewska et al., 2006) have provided evidence of such an orthogonal conceptualization. The first feature is a heightened awareness to sensory stimuli, or rather the tendency to notice more stimuli in one's environment and/or stimuli of lower intensity (sensory sensitivity). This characteristic affords HSPs a greater awareness of self and their environment. The second property is related to a low threshold for sensory processing, which is ease of overstimulation (sensory discomfort). Each of these will be discussed for their influence on the communication behaviors of HSPs.

First, the property of sensory discomfort refers to unpleasant affect such as irritation, pain, and discomfort resulting from qualities of stimulation intensity, rate, complexity of light, movement, sound, smell/taste, temperature, and texture, and is functionally related to items on the HSPS that reflect negative affect, such as greater ease of excitation and a lower sensory threshold (Evans & Rothbart, 2008). Thus, it may be that for HSPs, feelings of sensory discomfort are exacerbated because they seemingly have an inability to ignore moderate environmental stimuli as well as a tendency to ruminate on strong sensory input. As Aron (1996) states, "what is moderately arousing for most people is highly arousing for HSPs. What is highly arousing for most people causes an HSP to become very frazzled" (p. 7), likely causing a disruption in social processing. For HSPs, then, sensory discomfort inhibits the perception or

recognition of emotional states or ongoing communication attempts. If sensitivity to stimuli causes HSPs to experience greater sensory discomfort, then HSPs will be less able to process social information (Proposition 2).

Conversely, scholars have found that sensory sensitivity, apart from sensory discomfort, is a complex, multifaceted sensitivity to various types and grades of stimuli (Evans & Rothbart, 2008). Sensory sensitivity reflects an HSP's greater awareness of stimulation from multiple modalities, which includes automatic attention to both external sensory events and internal events (e.g., spontaneously occurring thoughts and images). Sensory sensitivity includes three qualities: 1) perceptual sensitivity, the awareness of slight, low intensity stimulation arising from within the body and the environment (e.g., I often notice visual details in the environment); 2) affective perceptual sensitivity, awareness of emotional valence associated with low intensity stimuli (e.g., I tend to notice emotional aspects of paintings and pictures); and, 3) associative sensitivity which is matching previous cognitive content (i.e., memories, experiences) that is not related to standard associations with the environment (e.g., I think about past conversations when involved in other activities). Perceptual, affective, and associative sensitivity are correlated to items on the HSPS which reference tendencies to be aware of one's aesthetic surroundings (e.g., Do you seem to be aware of subtleties in your environment?), and were largely unrelated to negative affect items of the HSPS. Each of the qualities of sensitivity to stimuli has potential impacts on communication.

Greater affective perceptual sensitivity likely has a positive influence on one's own emotional understanding. Indeed, HSPs are considered more self-aware of internal bodily states and are characterized as having greater "consciousness of self" (Aron & Aron, 1997, p. 349-350). As such, HSPs are thought to be more expressive of their emotions because they are more

in-tune with their mood (Aron & Aron, 1997). In additions, HSPs are not just more capable of identifying and expressing their feelings to another person; they also enjoy deep conversations about their self-reflections (Aron, 2000). HSPs "like to talk about complicated things like feelings and struggles" (p. 101), a quality of particular interest to individuals not thought to normally express their emotions (i.e., men). If HSPs, both women and men, are more self-aware because of a heightened sensitivity to their internal states (i.e., hunger, sadness, anxiety), then they are expressive of their feelings (Proposition 3).

Associative perceptual sensitivity, or "the frequency and remoteness of automatic cognitive activity" (Evans & Rothbart, 2008, p. 871), is reflected by the tendency to recall or experience cognitive content that is not related to one's current environment (e.g., I think about past conversations when involved in other activities). The belief that HSPs can be in a location such as a crowded classroom yet be daydreaming and playing out fantasies in their minds all the while is a quality noted by Aron (1996), as is a "sensitivity related to imagination" (Evans & Rothbart, 2008, p. 109). Thus, sensitivity to one's thoughts may influence intrapersonal communication constructs like imagined interactions. Imagined interaction refers to a process of social cognition whereby actors imagine and therefore indirectly experience themselves in anticipated and/or past communicative encounters with others (Honeycutt, 2003).

There are multiple attributes of imagined interactions (IIs) that may be influenced by SPS, the first of which is frequency, or the regularity with which IIs occur for an individual (Honeycutt, 2009). Because of a tendency to dwell in thought, HSPs are likely to both plan for and relive past interactions in their minds. In particular, Aron (1996) suggests that when anticipating conflict, HSPs "in a very real, arousing, semiconscious imaginary world, are already experiencing various ways the conversation might go, and most of them are distressing" (p. 156).

This quote hints at multiple attributes of IIs (at least those relating to conflict management), including proactivity, vividness, and negative valence. Higher SPS, then, may be related to an increase in proactive IIs, which are imagined interactions that occur before an anticipated encounter. Other characteristics influenced may be valence, which refers to the diversity and direction (positive or negative) of emotions that are experienced while envisioning conversation (Honeycutt, 2009), and specificity, which reflects the level of detail and distinction of images contained within IIs.

Furthermore, HSPs likely spend more time reliving their past conversations (Aron, 1996). Retroactive IIs serve the function of helping to review what occurred during an interaction, which, generally, is a positive function. But in a certain percentage of individuals, retroactive IIs reflect rumination and cause the individual to persistently reflect on negative messages (causing negative affect) (Honeycutt, 2009). The latter case seems possibly true for HSPs given the strong relationship between SPS and neuroticism or negative emotionality. Thus, if HSPs are more self-aware of internal states, then they will more often experience intrapersonal social cognitions (Proposition 4).

Overall, as central as sensitivity to puntate, physical stimuli is to the construct of SPS and a tendency to become over-aroused, other sensitivities are also part and parcel of SPS. Indeed, affective perceptual sensitivity is important to the communication of one's own emotions and associative sensitivity is related to greater cognitive processing before and after interactions.

**Processing Depth.** Aron and Aron (1997) define a central feature of SPS as greater "depth of discrimination" (p. 350) which is reflected by evidence that HSPs spend longer amounts of time processing sensory information and process at higher intensities (Jagiellowicz et al., 2011). The quality of depth of processing is believed to allow HSPs to more finely

discriminate between subtle cues and nuanced differences, but it can also cause a cognitive backlog of information.

Deeper processing manifests itself in actual brain activation differences as demonstrated by results from an fMRI study on SPS. In this study (Jagiellowicz et al., 2011), 18 individuals who varied in their SPS scores carried out a change detection task in an fMRI scanner. Participants were asked to rate a series of landscape scenes for whether they were similar to or different from the previous one. The presentations were in random blocks, in which the variations (when there were variations) were either gross or subtle. The authors concluded that their results "support a relationship between SPS and both increased response time and increased brain activation in relevant regions in response to subtle changes in stimuli" (p. 45). That is to say, HSPs showed dramatically more activation, compared with non-HSPs, when doing minor (vs. major) discrimination tasks. However, that no difference in accuracy was identified. In general, results of the study provide evidence suggesting trait "SPS makes a unique contribution to individual differences in brain response" (p. 46-47), referred to hereafter as "deeper processing."

With respect to subtle communication and emotional cues, greater depth of processing may afford HSPs an enhanced capability to discriminate between similar emotions, thereby increasing interpersonal sensitivity abilities. Greater detection of nuanced differences in micro-momentary facial expressions or slight variations in vocal expressions of emotions, along with a greater depth of processing, may enable HSPs to be more accurate judges of emotion. Referring back to greater perceptual sensitivity, HSPs may demonstrate greater ability to notice low intensity non-verbal cues or emotional expressions of others. For instance, studies of introverts indicate that they are more sensitive to low frequency sounds (Stelmack & Campbell, 1974).

Therefore, since HSPs are typically introverted they should be similarly perceptive of low intensity cues. If highly sensitive persons process non-verbal facial and vocal cues of social actors more intently (or "deeply"), then they may be more accurate at inferring true emotional states and able to sense and notice emotional leakages (Ekman & Friesen, 1969) (Proposition 5).

Deeper processing of sensory cues can also lead to negative outcomes, such as a build-up of unprocessed information which results in anxiety and arousal (see Beatty, 1981). Aron (1996) proposed when HSPs encounter stimulating messages (e.g., heavy content messages like those in an important lecture, highly emotional messages during an intense conflict), they more frequently experience decline in performance, a consequence attributed to increased processing durations. Longer sensory processing durations ultimately result in stalled cognitive processing of task information, thereby contributing to a buildup of cognitive backlog, a contributor to receiver apprehension (RA; Wheeless, 1975). RA, conceptualized as anxiety experienced at times when an individual must listen intently especially during situations that are stimulating or when one is being held accountable for the information being received, has been found to be correlated with SPS ($r$ = .21; Gearhart, 2011). As sensitivity increases, so do general feelings of RA indicating that depth of processing may cause HSPs to be worried about the possibility of information overload. If deeper processing contributes to cognitive backlog, then exposure to multiple or intense stimuli will cause HSPs to perform more poorly during cognitive processing tasks (Proposition 6).

**Emotional Reactivity.** A number of studies indicate that higher SPS is associated with greater emotionality, or negative affect, as evidenced by relationships with constructs such as neuroticism (Aron & Aron, 1997; Smolewska et al., 2006), anxiety (Liss, Timmel, Baxley, & Killingsworth, 2005), and emotional contagion (Gearhart, 2011). One manner in which

heightened emotional reactivity has predominately negative consequences for the individual in that they internalize or are hyper-sensitive to the comments of others (especially criticism) (Aron, 1996). Evidence of this aspect of SPS has been provided in the first direct experimental exploration of SPS and emotional reactivity. Aron et al. (2005, Study 4) evoked, in college students, an emotional reaction to either good or bad feedback about academic ability, and it was found that those scoring high on the HSPS had far stronger emotional reactions, both for positive and negative feedback, than those scoring low on the scale. If HSPs are more emotionally reactive, then they will be more responsive to the feedback of others (Proposition 7).

Depth processing and sensitivity to stimuli are thought to cause HSPs to be "more physiologically reactive" (Benham, 2006, p. 1437), causing HSPs to experience greater negative affect and anxiety during these aversive states. Indeed, several studies have identified relationships between SPS and a variety of types of stress, including work stress (Evers, Rasche, & Schabracq, 2008), academic and social stress in college (Gearhart & Bodie, 2012), and general stress, which occur due to greater levels of emotionality or emotional reactivity (Benham, 2006). Stress related to one's gender identity (O'Neil et al., 1986) could also be a result of increased emotional reactivity because HSPs are more aware of their failure to meet social expectations (see Aron, 2000). Thus, the following proposition is set forth: If HSPs are more emotionally reactive, they experience greater levels of stress (Proposition 8).

**Summary.** The numerous positive and negative consequences associated with inhibition of behavior, sensitivity to stimuli, deeper processing, and higher emotional reactivity listed above suggest a wide-range of implications for individual communicators. These effects, such as greater sensitivity to the criticisms of others, a more accurate ability to infer the emotional states of others, and a tendency towards over-arousal also extend into the relational lives of HSPs.

## Consequences for Relationships

An analysis of the potential influence of SPS on interpersonal communication should necessarily consider relational consequences. Outcomes such as fewer opportunities to meet relational partners, a decrease in shared "exciting" activities with actual partners, higher levels of empathy and understanding, and a tendency to withdraw from discussion when aroused by averse or intense stimulation are all suggested relational consequences of higher SPS (Aron, 1996, 2000).

**Inhibition of Behavior.** The impact of an individual's inhibition of behavior, or unwillingness to communicate, can have detrimental consequences for their relational lives. Like introverts, HSPs are thought to have more difficulty establishing relationships or finding relational partners (e.g., Cheek & Buss, 1981), developing intimacy in friendships (Buhrmester, 1990), and maintaining healthy relationships (e.g., Aron, Norman, Aron, McKenna, Heyman, 2000) because of inhibited social behavior. This hurdle has a suggested association with decreased relationship opportunities and relational quality for HSPs (Aron, 1996, 2000). For example, Aron (1996) suggested that HSPs may miss out on opportunities to meet others because they are over-concerned with managing or controlling their arousal. "Many HSPs avoid people who come in the overstimulating packages- the strangers, the big parties, the crowds" (p. 97), thus HSPs face difficulty when they are trying to develop a relationship with someone unaffected by crowds and the like. If (not when) HSPs are eventually able to overcome the initial stages of arousal and develop a close relationship, then it is important to the quality of the relationship to continue to engage in shared activities as demonstrated by a number of studies.

For example, Reissman, Aron, and Bergen (1993) recruited 53 married couples to take part in a 10-week study. Participanting couples were randomly assigned to one of three

conditions: in one condition, the couple was instructed to spend 1.5 hours per week doing an activity from a list of "exciting activities", as independently rated as highly exciting by each partner (e.g., attending musical concerts and outdoor activities like skiing); couples in a second condition were given a list of activities rated as highly "pleasant" but not as "exciting" (e.g., visiting friends, attending a movie, and eating out); couples in the third condition were a no-activity control group. All couples completed a standard marital quality questionnaire and a relationship-relevant social desirability scale at the start of the study and again after 10 weeks. A significantly greater increase in satisfaction in the exciting activities group than in the pleasant activities group was identified, supporting the belief that shared participation in novel and arousing activities increases marital quality.

Another study found similar relationships between relational quality and sharing exciting or novel experiences (Aron & Aron, 1996). "Over two questionnaire studies and three experiments, shared participation in novel and arousing activities was consistently associated with higher levels of experienced and behaviorally expressed relationship quality" (p. 281). Couples showed a significantly greater positive change, represented as less hostility and negative affect and more acceptance and support, after participating in the novel-arousing activity than in the mundane activity. Unfortunately HSPs often find themselves inhibited from participating in such activities (Aron, 1996, 2000). Indeed, sensation seeking (Aron et al., in press) and the Fun-Seeking subscale of the BAS (Smolewska et al., 2006) are negatively related to SPS. If the tendency for HSPs to avoid highly arousing activities prohibits engaging in types of shared experiences that enhance relational quality, then it seems that HSP relationships may be at risk of becoming unexciting and of low quality (Proposition 9).

**Sensitivity to Stimuli.** The two qualities of sensitivity to stimuli, sensory sensitivity and sensory discomfort, also influence relational quality and satisfaction. Sensory sensitivity has pro-social consequences that are related to increased attention to and recognition of a partner's emotional state, such that HSPs, in effect, "are more aware of what other people are feeling, what they want and need" (Aron, 2000, p. 56). In particular, Aron suggests "intimate" and "honest" relational communication is enhanced by a greater awareness of another's internal states (p. 156). The open sharing of feelings and honest communication is a hallmark of healthy, satisfying relationships, especially when the sharing of negative feelings is not done through criticism (Gottman, 1990). If highly sensitive partners are aware of others' feelings, then they should experience more understanding in their relationships (Proposition 10).

On the other hand, sensory discomfort prohibits some highly sensitive relational partners from engaging in activities with their partner that will be overstimulating. HSPs' high responsivity to sensory stimuli causes them to lose focus on conversational or social goals (Aron, 1996), thus keeping them from responding or interacting appropriately. Extended pauses or silences, failed attentiveness or listening attempts, and general distraction from verbal and non-verbal cues can each cause HSPs to process messages incompletely or more slowly under conditions of arousal or stimulation. For instance, in a study of workplace stress, Evers et al. (2008, p. 191) state that, "work and its environment are absolutely chaotic: a bombardment of strong, senseless stimuli that effectively disrupt every task. As a result, the work is incomprehensible and unmanageable" thus causing burnout symptoms for HSPs which are related to poorer social functioning in work places (Maslach, 1993). In the social world, then, dinner conversations while eating out, dialogue during a car ride in heavy traffic, and initial interactions during large or noisy gatherings all possibly represent situations where HSPs are less

effective in their social performance due to sensitivity to external stimuli. Indeed, Aron and Aron (1997) note that often times HSPs find the need to remove themselves from a high stimulation social situation like a party or a concert and take several minutes to "soothe" their sensory discomfort. One question on the HSPS asks, "Does your nervous system sometimes feel so frazzled that you have to get off by yourself?", reflecting the negative social impact of sensory discomfort. If HSPs are more prone to experience sensory discomfort, then they avoid engaging in highly stimulation activities with relational partners (Proposition 11).

**Processing Depth.** A greater ability to recognize non-verbal leakages of a relational partner extending from deeper cognitive processing of affective information has potential relational consequences. For example, previous research has demonstrated that people who are higher in inferential accuracy also report higher levels of empathy (Mayer, DiPaulo, & Salovey, 1990). Hall, Andrzejewski, and Yopchick (2009) suggest that higher inferential accuracy benefits relationship management skills like empathy because "noticing and accurately assessing others' cues is a precursor to being able to respond appropriately, which then enables a person to avoid social rejection and promotes positive changes" in behavior (p. 151).

Due to deeper processing, HSPs are able to "pick up on much more of the subtle cues, the nuances" (Aron, 1996, p. 156) and "greater awareness of the subtle tends to make [HSPs] more intuitive" (p. 7) to their partner's thoughts and feelings. HSPs are sensitive to what others are not saying and aware of what others imply but do not say which is to say that they are able to "sense" the emotions of another person and, thus, listen more "empathically" than non-HSPs (Aron, 2000, p. 174; Gearhart, 2011). Active-empathic listening (AEL) reflects a listeners' affinity to actively attend to the messages of that other with the goal of understanding their underlying emotional states (Bodie, 2011; Drollinger, Comer, & Warrington, 2006). This pro-

social attribute has demonstrated a moderate relationship with SPS such that higher SPS is related to more skilled AEL behavior, most specifically the sensing subscale which reflects attention to implicit meanings in conversations ($r$ = .25; Gearhart, 2011). AEL has been found to be most readily associated with skills that enable one to be an efficient and effective conversational partner (Gearhart & Bodie, 2011), thus, if HSPs more deeply process the messages of others, then relational partners should report more feelings of being listened to and understood (Proposition 12). Accordingly, if more empathy is conveyed by HSPs, then they should experience greater relational satisfaction (Proposition 13).

**Emotional Reactivity.** As indicated earlier**,** HSPs are more easily aroused by stimulation and criticism. For relationships, greater emotional reactivity often results in a need for HSPs to escape or take breaks from highly arousing situations, such as relational conflicts (Aron, 1996, 2000). Gottman (1990) postulated Diffuse Physiological Arousal theory to explain how overstimulation contributes to negative relational behaviors such as withdrawal. Diffuse Physiological Arousal (DPA) reduces the ability to process information, making overlearned behaviors and cognitions more likely to be engaged than newly acquired behaviors. Therefore, DPA increases the likelihood of the same behaviors that are engaged during fight or flight (i.e., withdrawal and aggression) (p. 88). Due to low thresholds for BIS reactivity, HSPs are more likely to manage their own level of negative affect by taking steps to keep it from escalating, such as withdrawing or taking timeouts (Aron, 1996, 2000). If HSPs are more emotionally reactive, then they will more frequently withdraw from conflict situations (Proposition 14).

Aron et al. (in press) pondered whether the tendency to be "affected more by another's mood (also an item [in the HSP Scale]) lead[s] to greater empathy" (p. 16). They suggested that higher emotional reactivity can have individual effects on empathic attributes such as emotional

contagion and emotional concern. Evidence shows that HSPs are more likely to experience both of these when witnessing the unequal or mistreatment of others (Gearhart, 2011). Whereas emotional contagion necessitates some degree of correspondence in affect, emotional concern stipulates that the affect of the target and the perceiver are different. For example, the observation of a person in distress should activate a parallel, negative response (contagion) and a positive, non-parallel response (concern). Indeed, sensitivity to the needs of others is a feature of SPS. Therefore, if HSPs experience greater levels of emotional reactivity, then heightened feelings of sympathy exist (Proposition 15).

**Review of Implications**

The influence of SPS on individual abilities and behavior, and subsequently on interpersonal relationships, is both positive and negative. Depth processing, sensitivity to stimuli and stronger emotional reactions all have been suggested to have pro-social consequences. These attributes likely contribute to HSPs' higher levels of empathy and greater understanding of a relational partner's wants and needs, which lead to more intimate and honest communication since HSPs are more emotionally expressive and better listeners. These features of SPS, however, also create social hurdles for HSPs in the presence of moderate or high stimulation. Depth of processing, for one, can cause heightened levels of arousal due to overstimulation. As HSPs are more attentive to the sensory cues in their environment and they process them deeper, this causes an inhibition of behavior, avoidance of certain people or places, or withdrawal from communication situations. It seems apparent, then, that biological traits like SPS can impact communication in important ways, and such speculation is substantiated by the paradigm of communibiology.

## Research Questions

Evident in the propositions (see Table 2.1) is that the influences of SPS on communication are varied and complex: intrapersonal, individual, and interpersonal, as well as positive and negative, gross or subtle. Any research project that attempted to test all of the above propositions would require massive effort and resources, therefore only two sets of focused questions will guide this dissertation. The first set of questions is generally stated for any HSP, male or female, while the second set of questions is specifically concerned with highly sensitive men (see Table 2.2).

Table 2.2: Primary research questions

| | |
|---|---|
| Question Set One | |
| Q1.1 | What are the impacts of SPS on the individual as related to deeper processing? That is, are HSPs more accurate at identifying the emotions of others? |
| Q1.2 | What are the impacts of SPS on the individual as related to overstimulation? That is, are HSPs more distracted by stimulation; |
| Q1.3 | And, Does distraction affect HSPs more negatively in terms of task performance? |
| Question Set Two | |
| Q2.1 | Do HSM demonstrate different relationship behaviors than non-HSM; |
| Q2.2 | Specifically, does hyper-awareness towards the feelings of others influence HSM to engage in positive behaviors such as listening and greater expressivity; |
| Q2.3 | Specifically, does greater emotional reactivity cause negative outcomes such as withdrawal and tendency to evaluate messages more negatively? |
| Q2.4 | Are HSM more “feminine” than non-HSM; |
| Q2.5 | If so, does this cause them greater gender role stress? |

Multiple propositions are incorporated into the research questions such that the sets of queries organize predictions into general categories regarding the influence of SPS on individuals and relationships. In order to answer these questions, and to test a number of the

propositions cited above, two studies are reported. The first set is answered via an experiment that tested the non-verbal decoding ability of HSPs when they were exposed to (or not) external stimulation (i.e., radio static). Examinations of differences between HSPs and non-HSPs regarding distraction and task performance as well as differences between varying conditions of stimulation intensity were performed. For the second set, a self-report study compared the relationship quality and relational maintenance behaviors of couples that do or do not include a highly sensitive male. Furthermore, investigations into claims that highly sensitive men are more "feminine" (Aron, 2000) were conducted. To be clear, all of the questions and propositions proposed in this dissertation are expansions of claims made by Aron (1996, 2000; Aron & Aron, 1997). Many of the claims, such as claims to overarousal and HSM femininity, have yet to be supported with evidence.

These questions are important because they provide foundations for understanding how SPS influences recognition and expression of emotion, processes that are central to communication as well as healthy relationship development (e.g., Salovey & Mayer, 1990). For instance, answers to questions surrounding the inferential accuracy ability of HSPs can be considered foundational building blocks because they reflect one of the most basic forms of human communication-- understanding non-verbal cues of others. Indeed "noticing and accurately assessing others' cues is a precursor to being able to respond appropriately, which then enables a person to avoid social rejection and promotes positive changes" in behavior (Hall, Andrzejewski, & Yopchick, 2009, p. 151). For example, higher inferential accuracy benefits relationship management skills like empathy, conversational sensitivity, social support, and conflict management.

Therefore, examining if HSPs are better decoders of non-verbal cues allows this dissertation to shine a light on a fundamental process for human understanding and communication. Practically speaking, once we come to understand the positive and negative influence of SPS on emotional decoding, we can teach HSPs to maximize the positives of their sensitivity as well as provide suggestions for behavioral modification to limit the detrimental effects of SPS on non-verbal recognition. Theoretically, findings related to inferential accuracy may be important for the emotional intelligence paradigm (Salovey & Mayer, 1990) by providing a possible biological source to explain why some persons are more emotionally intelligent than others.

With respect to questions of gender role stress and affect management behaviors, these questions are important because they extend the focus beyond understanding the effects of SPS on non-verbal decoding ability by beginning to investigate differences in verbal communication behaviors as well as within interpersonal relationships because communication is often thought of in terms of face-to-face interaction. For example, when participants completing self-report surveys are asked to recall retrospective accounts of listening behavior, they often think of communication situations as involving two people communicating face-to-face (Purdy, 2006; Bodie, Vickery, & Gearhart, in press). Thus, when studying the influence of SPS on communication we must consider a context such as romantic relationships.

Practically, by understanding the behaviors that HSM engage in more frequently as well as the positive and negative consequences relating to these behaviors, it is possible to identify communication skills and strategies that may facilitate the growth of pro-social behaviors and deter destructive behaviors like withdrawal. Theoretically, this dissertation provides one mechanism to explain deficits in relationship satisfaction by examining the role that SPS, most

specifically emotional reactivity, plays in inhibiting or escalating the expression of or attention to emotions. Furthermore, HSPs' greater attention to internal states ("greater consciousness of self"; Aron & Aron, 1997, p. 349-350) opens the door to bodies of literature regarding self-awareness and its role in relationships and behavior (e.g., Silvia & Duval, 2001).

By moving from the individual to the relational, and moving from non-verbal to verbal, this dissertation expands to focus in such a way that a more holistic impression can be made regarding the influence of SPS on communication. Furthermore, answers to these questions position SPS into larger bodies of literature on self-awareness, emotional intelligence, and interpersonal sensitivity.

## Summary

Beatty et al. (1998) proposed the paradigm of commmunibiology to implicate biology as the primary determinant of human communication behavior. As proposed in this dissertation, SPS, a biological trait related to cognitive processing and physiological reactivity, plays a significant role in the selection of environmental stimuli, how it is processed, and the reactions to the stimuli and processing. Ultimately, the four qualities of SPS -- inhibition of behavior, greater awareness of sensory stimulation, deeper processing of sensory information, and stronger emotional reactions (Aron, et al., in press, p. 6) -- all influence HSPs and their communication skills, dispositions, and outcomes. Sensory-processing sensitivity is speculated as the root cause of feelings of apprehension, anxiety, and empathy, as well as behaviors and abilities such as greater inferential accuracy, higher arousal, more emotional expressivity, and better understanding. While these are only some of the communication skills or tendencies that emanate from or are affected by an individual's inherited sensory-processing sensitivity, they are

considered fundamental claims to the construct of SPS which, to this point, are undocumented and should be tested. It is to such tests that Chapters Three and Four now turn.

# CHAPTER THREE

## STUDY ONE

The purpose of this study is to demonstrate evidence of construct validity for the sensory-processing sensitivity measure as well as test theoretical propositions outlined in Chapter Two regarding arousal and non-verbal decoding accuracy. Specifically, this chapter focuses on Propositions 2, 5, and 6 (see Table 2.1) which suggest HSPs have greater non-verbal decoding ability, but when exposed to stimulation they become more distracted and suffer greater detriments to judgment accuracy. In particular, this research project focuses on four theoretical facets of sensory-processing sensitivity (SPS): (a) inhibition of behavior; (b) greater awareness of sensory stimulation, so that more subtleties are noted, but overstimulation is also possible; (c) deeper processing of sensory information; and (d) stronger emotional reactions (Aron, et al., in press, p. 6).

In general, these characteristics are considered for the ways in which they enhance and/or inhibit accurate assessments of non-verbal expressions of emotion. Inferential accuracy or "accuracy in noticing and recalling another's nonverbal cues, speech content, or physical appearance" (Hall, Andrzejewski, & Yopchick, 2009, p. 150) is related to a host of positive interpersonal consequences. However, sources of accuracy are relatively unknown and understudied. It may be that greater discriminatory ability and awareness of stimuli promote greater recognition of non-verbal expressions of emotion for highly sensitive persons than non-sensitives. Thus, if highly sensitive persons are more sensitive to and able to discriminate between the subtle emotional expressions of others, then they demonstrate higher scores on tests of non-verbal decoding accuracy.

## Decoding Ability and Arousal

The four qualities of SPS listed above have been proposed as having both positive and negative influences on communication behaviors of highly sensitive persons (see Chapter Two). Positively, these qualities are thought to enhance communication by allowing highly sensitive persons (HSPs) to notice more subtle changes in emotion due to deeper processing (Jagiellowicz et al., 2011). Furthermore, awareness of slight changes in stimuli and greater associative awareness causes HSPs to draw cognitive connections to relevant stimuli allowing for more intuitive judgments of others' emotional states (Evans & Rothbart, 2008). On the other hand, greater awareness of stimuli is a cause for distraction (Aron & Aron, 1997) such that when deeper processing of irrelevant, extraneous stimuli occurs or if HSPs physiologically react to moderate or high stimuli (Benham, 2006), they become cognitively and behaviorally impaired (Gottman, 1990). Each of these assertions is tested with specific hypotheses detailed below.

### Positive Implications

HSPs are considered to have "sensitivity to both internal and external stimuli, including social and emotional cues" (Aron et al., 2010, p. 220). In support of this, HSPs experience greater brain activation when processing minor changes in landscape images (Jagiellowicz et al., 2011) and are higher in perceptual sensitivity, or the natural tendency to attend to non-verbal and affective cues of a social actor (Evans & Rothbart, 2008). Greater depth of processing allows HSPs to be more aware of subtle communication cues such as micro expressions or emotional leakages (Ekman & Friesen, 1969), and helps HSPs to better discriminate between conceptually similar emotions like anger and contempt. Thus, HSPs should be more accurate at recognizing emotional states given their tendency to notice particularly subtle changes in behavior or nuances in cues.

Greater awareness of sensory cues, or "sensitivity to stimuli", allows HSPs to notice relatively minor signals from their surroundings. An inherent, unconscious ability to process cues at greater depths causes HSPs to "pause and check" before acting, making them slower to act since they "prefer to pause and reflect after it, 'stopping to check it out' rather than 'forging ahead'" (Aron & Aron, 1997, p. 347). The propensity to pause and thoroughly process sensory information likely has a positive impact on the recognition of others' emotions. In fact, previous research has found that being more hurried, the opposite of "pausing and checking", is associated with lower inferential accuracy (Hall, Andrzejewski, & Yopchick, 2009, p. 164).

Inferential accuracy (Hall, Carter, & Horgan, 2001) is measured via tests of non-verbal decoding accuracy utilizing posed actors, and may be functionally related to deeper processing by HSPs because they are able to make more "intuitive" judgments about how people feel based upon minimal information (Aron, 1996, p. 4). If highly sensitive people more deeply process subtle stimuli, and if this allows them to make intuitive judgments about emotions, then HSPs will have greater inferential accuracy (Proposition 5). This proposition is tested with the following hypothesis:

H1: Highly sensitive persons are more accurate on a test of non-verbal decoding than non-sensitive persons when not exposed to stimulation.

**Negative Implications**

Ultimately, however, the possible positive outcomes of deeper processing and greater awareness of sensory stimulation are balanced out by negative consequences associated with overstimulation. A predisposition to process sensory cues at low thresholds of stimulation contributes to higher levels of arousal in HSPs when cues are of moderate or high intensity (Aron, 1996; Benham, 2006). Sensory cues such as sirens or repetitive noises, glaring lights, or

strange odors represent types of stimulation that "over-tax" the cognitive systems of HSPs (Aron, 1996, p. 4). While non-HSPs are able to ignore or disregard such cues rather quickly and focus attention back to their social goals, HSPs cognitively attend to and ruminate on annoyances, which interferes with goal directed activity until the stimulation ceases or is avoided. As a result, HSPs are likely to become more aroused and more distracted, often resulting in decreased cognitive ability (Aron & Aron, 1997; Gottman, 1990) and social performance (Gearhart & Bodie, 2012) as well as a desire to withdraw from the situation to decrease arousal (Aron, 1996, 2000). If highly sensitive people process sensory information more intensely than non-HSPs, then they will experience greater levels of discomfort when presented with stimuli (Propositions 2); and, then HSPs will be less accurate at tests of decoding accuracy when exposed to adverse stimulation (Proposition 6). The following hypotheses are presented to test these propositions:

H2: Highly sensitive persons report thinking more about their surroundings than non-sensitive persons when exposed to moderate and high stimulation.

H3: Highly sensitive persons are less accurate at tests of non-verbal decoding than non-sensitive persons when exposed to moderate and high stimulation.

In consideration of the aforementioned hypotheses, an experiment was conducted to test the theorized positive and negative consequences of hyper-awareness to and deeper processing of social and sensory information. Participants first completed a self-report instrument measuring their level of sensory-processing sensitivity and a number of other unrelated measures. After at least 24 hours, subjects reported to a computer laboratory where they were randomly assigned to one of three conditions (control, moderate stimulation, and high stimulation) to be assessed on tests of non-verbal accuracy (i.e., Diagnositic Analysis of Non Verbal Accuracy-2; Nowicki & Duke, 1994). Then, in a post-treatment survey, students self-reported their levels of distraction

and awareness of sensory stimulation. Scores on the accuracy tests and distraction measures were compared across conditions as well as between groups of HSPs and non-HSPs.

## Method

### General Setup

This experiment utilized a 2 (HSPS self-reported sensitivity: HSP, non-HSP) X 3 (stimulation intensity: control, moderate, high) factorial design. Undergraduate research assistants were trained to adminster and monitor the experiments, and were instructed as how to brief participants on the testing procedures.

### Participants

A total number of 342 participants completed both parts of the study (the online portion and the non-verbal detection tasks). The 230 female and 101 male (11 did not report biological sex) participants reported an average age of $M$ = 20.33 ($SD$ = 4.04) years and primarily Caucasian ethnicity ($n$ = 269). Other race/ethnicities were marked including African-American ($n$ = 53), Asian-American ($n$ = 13), Hispanic/Latino/Chicano ($n$ = 11), Native-American ($n$ = 2), Pacific Islander ($n$ = 1), and Other ($n$ = 1). One person did not report his/her ethnicity/race, and 11 students identified with two or more ethnicities/race(s). All class ranks were represented: Freshman ($n$ = 80), Sophomore ($n$ = 138), Junior ($n$ = 60), Senior ($n$ = 47), and Graduate ($n$ = 2), however 15 persons did not report their class. Though participants were gathered from a convenience sample of Louisiana State University students enrolled in Communication Studies courses, 16 (out of a possible 17) academic programs were represented.

### Procedures

Students were recruited for the study via an online scheduling system whence they were able to select from a variety of research credit opportunities. Only those students enrolled in

Communication Studies classes that required research participation were permitted to complete the survey. All students received a small amount of required research credit for their participation (1.5% of their course grade). All data collected were confidential, all students provided informed consent, and all procedures were approved by the LSU Institutional Review Board for human subjects (see Appendix H).

G*Power 3.1(Faul, Erdfelder, Buchner, & Lang, 2009) was utilized *a priori* to determine sample size requirements necessary to identify fixed, special, main effects and interactions in a 2 X 3 factorial analysis of variance (ANOVA). In order to detect medium interaction effects ($\rho$ = .25) at the .05 significance level, the total number of participants should be 323 with at least 54 participants included in each of the 6 groupings (see Table 3.1). While the criterion for the total number of study participants was satisfied, unfortunately several groups lacked equivalent sizes as recommended. Approximately 50% of the total sample population should be highly sensitive (~ 162 subjects), distributed equally between each condition (~ 54) as classified based upon dichotomized scores on the Highly Sensitive Persons Scale (Aron & Aron, 1997). Time limitations prohibited the collection of a large enough sample size to yield the recommended number of highly sensitive participants.[1] Participants were randomly assigned to conditions of stimulation via a random-number printout and were distributed roughly equally between the three stimulation conditions. Table 3.2 presents the segmentation of the participants. For detecting special, main and interaction effects, post-hoc power analyses indicated total power was .45 for detecting small (.10) effects, .99 for detecting medium (.25) effects, and in excess of .99 for detecting large (.40) effects given a sample size of 342 (considering equivalent group sizes). In detecting fixed effects for omnibus one-way ANOVA, post-hoc power analyses

[1] Data were collected for a total of 120 hours over two academic semesters and six weeks during summer course offerings.

indicated total power was .25 for detecting small (.10) effects, .96 for detecting medium (.25) effects, and in excess of .99 for detecting large (.40) effects given a sample size of 342 (considering equivalent group sizes).

Table 3.1: G*Power 3.1 *a priori* sample size recommendations

| | Groups | Numerator df | **Total sample size** |
|---|---|---|---|
| Sensitivity factor (A) | 6 | 1 | 210 |
| Stimulation factor (B) | 6 | 2 | 251 |
| Interaction effect (A*B) | 6 | 5 | 323 |

Table 3.2: Sample sizes by sensitivity and stimulation condition

| | Highly Sensitive | Non-Sensitive | **TOTAL** |
|---|---|---|---|
| Low Stimulation | 28 | 74 | 102 |
| Moderate Stimulation | 31 | 69 | 100 |
| High Stimulation | 31 | 109 | 140 |
| **TOTAL** | 90 | 252 | 342 |

Prior to their lab time, students completed an online survey in which they were administered several individual difference scales, including the Highly Sensitive Persons Scale (HSPS; Aron & Aron,1997), the Conners and Wells ADD/H Adolescent Self-Report Scale (Version 1.0) (Robin & Vandermay, 1996), the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991), BIS/BAS reactivity scales (Carver & White, 1994) as well as basic demographic information. Next, during a time slot scheduled at their convenience, participants completed three sections of the Diagnostic Analysis of Non-Verbal Accuracy-2 (DANVA-2; Nowicki & Duke, 1994), which includes tests measuring the accurate recognition of emotional expression in the voice, face, and body. Only one student was tested per timeslot to prevent any cross-contamination between participants, and average time to complete all three parts of the diagnostic test was about 13 minutes.

When a student arrived at the laboratory, which was a new computer lab with approximately 11 computers at individual carousels, he or she was randomly assigned to one of three stimulus conditions: high stimulation ($n$ = 140), moderate stimulation ($n$ = 100), or a control group ($n$ = 102). The stimulus utilized in this experiment was audio stimulation, which was chosen because a pilot study indicated that audio recordings provided a more consistent and controlled source of stimulation to the subjects (see Appendix A).

Audio stimulation was operationalized as audio recordings of previously recorded radio static at different levels of intensity. No static noise was emitted from the headphones in the control group. For the moderate stimulation condition, intermittent radio static was played through headphones such that static was presented for 2-5 seconds followed by 10-15 seconds of silence, a pattern that repeated for the duration of the experiment; by contrast, the high stimulation condition presented the participant with constant radio static noise. Both stimulation conditions maintained the same volume levels (approximately 80-90 dBs). Regardless of condition, all subjects were asked to wear headphones throughout the experiment.

Students were instructed to complete three separate parts of the DANVA-2 (Nowicki & Duke, 1991): the adult postures test (POS), the adult facial recognition test (AF), and the adult paralanguage test (AP). Each participant was randomly assigned to a varying sequence of tests (e.g., POS, AP, AF; AP, POS, AF; etc.) to prevent any possible sequencing effects (Rohsenow & Niaura, 1999). The directions for each of these tests are included in Appendix B. Each task allows for the assessment of participants' ability to identify the non-verbal communication of emotion differing in its level of intensity, and four basic core emotions are measured for receiving skills: happiness, sadness, anger, and fear. In other words, only the four basic

emotions are tested for recognition, and only these four forced-choice emotions are available for selection (e.g., there is no *Neutral* emotion or open ended response).

Participants were briefed on the procedures for completing the accuracy tests as well as the corresponding manipulation checks by the research assistant. The research assistant was present in the room during the course of the tests for the purpose of resolving any possible technical difficulties and answering questions about the experiment process as well as insuring participants wore headphones for the duration of the experiment. Assistants were instructed to not be bothersome to or interact with the participants or reveal study purposes.

Twelve manipulation check questions were administered post-treatment. The order of the questions was randomized. Four questions each were used to measure 1) feelings of audio distraction, 2) feelings of visual distraction, and 3) intensity of thoughts of regarding the comforts of the room.

**Measures**

The DANVA-2-AF (Adult Faces) consists of 24 photographs of an equal number of happy, sad, angry and fearful facial expressions of high and low intensities (Nowicki & Duke, 1994). Photographs included in the final form were composed of an equal number of male and female and high and low intensity facial expressions, and included a variety of ages and races. Images are displayed on a computer screen for approximately two seconds and then disappear, leaving participants to select their impression of the actor's emotional expression as happy, sad, angry, or fearful. Respondents are allowed an infinite amount of time to select their impression of the facial expression before moving to the next image. Scores on the DANVA-2-AF have been found to be consistent over time, and the DANVA-2-AF also has demonstrated convergent

validity (see Nowicki & Carton, 1993), discriminant validity (Nowicki, 1995), and criterion validity (McIntire, Danforth, & Schneider, 1997; Carton, Kessler, & Pape, 1999).

The DANVA-2-POS (Adult Postures) consists of 24 photographs of an equal number of happy, sad, angry and fearful emotions, of high and low intensities, and in both standing and seated postures. Faces of the posed actors are blacked out to prevent respondents from making assessments based upon information other than body posture. Images are displayed on the computer screen for approximately two seconds and then disappear, leaving participants to select their impression of the actor's emotional expression as happy, sad, angry, or fearful. Respondents are allowed an infinite amount of time to select their impression of the facial expression before moving to the next image. Pitterman and Nowicki (1999) found the DANVA-2-POS to demonstrate adequate test-retest reliability among two samples of college students, $r(34) = .69$, $p < .05$. That study also reported evidence supporting the convergent, discriminant, and criterion validity of the DANVA-2 in samples of college students.

The DANVA-2-AP (Adult Paralanguage) is a test of ability in accurately identifying the emotions of a speaker solely upon listening to a simple utterance. Actors and actresses express happy, sad, angry, and fearful feelings when saying a neutral sentence, "I am going out of the room now but I'll be back later." Recorded statements differ in intensity but maintain equal volume. The test contains 24 total recordings with an equal number of male and female trials of high and low intensity, happy, sad, angry, and fearful voices. Participants listen to a statement and are then asked to select the appropriate emotion they believe is being expressed by the actor. No images are presented with the audio samples, and respondents are allowed to repeat the statements as frequently as they desire. Nowicki (1995) reported that the DANVA-2-AP demonstrated strong test-retest reliability for college students over a six week period, $r = .83$, and

the study also provided evidence for convergent validity. An example of discriminant validity evidence is that scores on the DANVA-2-AP were not related to IQ tests indicating that emotional decoding is separate from intelligence (Nowicki & Duke, 2001).

**Highly Sensitive Persons Scale.** The Highly Sensitive Persons Scale (Aron & Aron, 1997) asks participants to respond to 27 statements regarding their sensitivity. This scale was modified from the original forced choice (*True* / *False*) response format to a more conventional 7-point Likert scale (midpoint = *Neutral*), which is consistent with previous research (e.g., Evans & Rothbart, 2008; Smolewska, McCabe, & Woody, 2006). Previous evidence of construct validity has been demonstrated through correlations between SPS and neuroticism and introversion (Aron & Aron, 1997; Smolewska et al., 2006), suggesting that temperament trait SPS is related to personality (Evers, Rasche, & Schabracq, 2008). Moreover, SPS is related to Gray's Behavioral Inhibition System (BIS; Gray, 1991) which provides further construct validity evidence for temperament trait SPS (Smolewska, McCabe, & Woody, 2006).

The HSPS was originally proposed as a unidimensional scale (Aron & Aron, 1997), although several items are psychometrically poor and nine items have been recommended for removal (Smolewska et al., 2006). As such, this study will utilize the shortened 18-item version of the HSPS for group assignment.[2] Confirmatory factor analysis (CFA) was conducted utilizing Amos 19.0 to assess the fit of the HSPS to these data. Commonly used fit indices and comparison thresholds were used to evaluate all CFA fit statistics, including the comparative fit index (CFI) above .90, the standardized root mean square residual (SRMR) below .10, and the root mean square error of approximation (RMSEA) below .08. Standardized residual covariances among items were inspected for values greater than two in absolute value. Specifics

[2] A number of subsequent studies have confirmed the item reduction (Gearhart, 2011; Ahadi & Basarpoor, 2010; Evans & Rothbart, 2008; Evers, Rasche, & Schabracq, 2008). Items removed can be found in Appendix C.

related to these statistics are found in an assortment of different sources (e.g., Byrne, 2010; Hoyle, 2000; Hu & Bentler, 1999; Kline, 2005; Raykov & Marcoulides, 2006).

Initial fit statistics for the 18-item unidimensional factor structure, $\chi 2$ (135) = 484.41, $p <$ .01, SRMR = .08, CFI = .75, RMSEA = .09 (90% CI: .08 .10), indicated model with low CFI and high RMSEA values, and further evaluation identified high standardized residual covariances. CFA has been recognized as a technique useful for removing problematic scale items, specifically those with low loadings, in order to reproduce a measure that demonstrates a better fit to data (Levine, 2005). With the present data, after removing five items[3] due to low loadings or high standardized residual covariances, fit statistics indicated an improved model fit, $\chi 2$ (65) = 139.08, $p < .01$, SRMR = .05, CFI = .92, RMSEA = .06 (90% CI: .05 .07). Scale reliability proved to be adequate, $\alpha = .82$. The items retained are listed in Table 3.3.

Table 3.3: Items and statistics for the HSPS

| ITEM | λ | *M* | *SD* |
|---|---|---|---|
| Do other people's moods affect you? | .54 | 4.54 | 1.48 |
| Do you tend to be more sensitive to pain? | .40 | 3.57 | 1.63 |
| Do you startle easily? | .44 | 3.74 | 1.68 |
| Are you annoyed when people try to get you to do too many things? | .54 | 4.46 | 1.53 |
| Do changes in your life shake you up? | .62 | 3.93 | 1.60 |
| Do you find it unpleasant to have a lot going on at once? | .56 | 4.07 | 1.52 |
| When you must compete or be observed while performing a task, do you become so nervous or shaky that you do much worse than you would otherwise? | .54 | 3.75 | 1.69 |
| When you were a child, did your parents or teachers seem to see you as sensitive or shy? | .33 | 3.74 | 2.06 |
| Do you seem to be aware of subtleties in your environment? | .25 | 4.46 | 1.40 |
| Do you find yourself needing to withdraw during busy days, into bed or into a darkened room or any place where you can have some privacy and relief from stimulation? | .52 | 3.83 | 1.79 |
| Are you easily overwhelmed by things like bright lights, strong smells, coarse fabrics, or sirens close by? | .68 | 3.03 | 1.65 |
| Are you made uncomfortable by loud noises? | .56 | 3.24 | 1.60 |
| Do you become unpleasantly aroused when a lot is going on around you? | .66 | 3.18 | 1.50 |

[3] Items removed included in Appendix C.

For group membership and analysis purposes, the remaining 13 items were averaged for a total overall HSPS score ($M$ = 3.81; $SD$ = .91; average interitem $r$ = .26). Then, according to distributions noted by Aron (1996), overall scores were dichotomized at about the 20$^{th}$ percentile to form groups of highly sensitive persons ($M \geq 4.35$) and non-sensitive persons ($M < 4.35$) (see Appendix D for histrogram). 90 participants were identified as highly sensitive while the remaining 252 were classified as non-sensitive (see Table 3.2). Given stratified, random assignment to condition, a similar number of highly sensitive persons were in each condition.

**Distraction.** Items and item statistics for the distraction measures are presented in Table 3.4. In total, 12 items were utilized, divided amongst three separate scales containing four items each which measured participants' feelings of audio, visual, and general distraction. Scores were recorded on 5-point Likert response scales. All items for the measures were created exclusively for this research project, and all subscales demonstrated adequate internal consistency estimates ($\alpha > .70$). The audio subset was created for manipulation check purposes, while the visual distraction items served a filler purpose. Fit statistics, $\chi 2$ (51) = 120.06, $p < .01$, SRMR = .05, CFI = .96, RMSEA = .06 (90% CI: .05 .08), indicated a good model fit.

Table 3.4: Items and statistics for the distraction measures

| SCALE ITEM | Avg. $r$ | $\alpha$ | $\lambda$ | $M$ | $SD$ |
|---|---|---|---|---|---|
| **Visual** | .57 | .84 | .75 | 1.44 | .72 |
| I had difficulty concentrating on the survey because I was thinking about sights around me. | | | .76 | 1.46 | .88 |
| I found myself thinking about the sights of the room. | | | .78 | 1.51 | .97 |
| I found myself to be highly bothered by the sights of the room. | | | .82 | 1.34 | .74 |
| While taking the survey I was distracted at times by something I could see in the room | | | .78 | 1.45 | .90 |
| **Audio** | .55 | .83 | .71 | 2.48 | 1.25 |
| I found myself thinking about other sounds. | | | .76 | 2.38 | 1.49 |
| I found myself to be highly bothered by sounds I heard. | | | .73 | 2.37 | 1.49 |
| I found myself thinking about the sounds I was hearing other than the task instructions. | | | .83 | 2.61 | 1.56 |
| While taking the survey I remember taking note of the sounds around me. | | | .66 | 2.58 | 1.57 |

*(table 3.4 continued)*

| | | | | | |
|---|---|---|---|---|---|
| **General** | .42 | .74 | .74 | 1.87 | .92 |
| Something other than the task at hand got my attention while taking this survey. | | | .68 | 2.21 | 1.45 |
| I found myself thinking about distractions in the room. | | | .69 | 1.79 | 1.22 |
| I remember thinking about ways to become more comfortable by changing the sights in the room. | | | .53 | 1.45 | .87 |
| I found myself concentrating on sights and sounds around me. | | | .72 | 2.03 | 1.27 |

**Attention Deficit Disorder.** Attention Deficit Disorder was measured using the short form of the Conners and Wells ADD/H Adolescent Self-Report Scale (Version 1.0) which provides a unidimensional index of ADHD symptoms and burden (Robin & Vandermay, 1996). The instrument includes 11 items scaled on a 4-point response system indicating the extent to which respondents have been bothered by each item (*1 = Not At All, 2 = Just A Little, 3 = Pretty Much, 4 = Very Much*). Other measures of ADD/H such as the Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) were costly in terms of dollars and participant attrition (150 items), and required the purchaser to show proof of a Doctorate degree in Psychology. Therefore, this brief, parsimonious measure allowed for ease of use by lessening the burden on research participants. Psychometrics of the Conners and Wells ADD/H scale have been tested with more than 100 adolescents who were previously diagnosed as having attention deficit hyperactivity disorder (ADHD) (Robin & Vandermay, 1996). Results indicated that non-ADHD participants scored significantly lower than their ADHD counterparts. Further, this measure has been shown to have a strong effect size of $r = .76$ in determining ADD symptoms according *DSM-III* criteria (Frazier, Youngstrom, Glutting, & Watkins, 2007).

In a validity comparison study with another measure of ADHD, researchers found that the Conners' measure provided a reasonable assessment of ADHD symptoms and burden, and the one-dimensional structure demonstrated adequate psychometric properties (Erhart, Dopfner, & Ravens-Sieberer, 2008). The measure demonstrated strong estimates of reliability, a stable

factor structure, and evidence of convergent and discriminant validity. Although the German measured performed slightly better than the Conners' at predicting ADHD diagnoses, the instrument is prudent for the research goals and analysis purposes of this study.

Fit statistics, $\chi 2$ (44) = 315.08, $p < .01$, SRMR = .075, CFI = .84, RMSEA = .13 (90% CI: .12 .15), indicated model with low CFI and high RMSEA estimates. Further evaluation of standardized residual covariances identified several misfitting items with values above two in absolute value. With these data, after removing two items[4], fit statistics indicated an improved model fit, $\chi 2$ (27) = 134.62, $p < .01$, SRMR = .05, CFI = .92, RMSEA = .10 (90% CI: .09 .13). Although RMSEA values still hovered above conventional criteria, all standardized residual covariances were low (< 1.60), and inflated RMSEA estimates can be products of low degrees of freedom in the model (Kenny, Kaniskan, & McCoach, 2011). Scale reliability of the remaining nine items proved to be adequate, $\alpha = .87$ ($M = 2.06$; $SD = .62$; average interitem $r = .43$). The items and item statistics are listed in Table 3.5.

Table 3.5: Items and statistics for the Conners and Wells ADD/H Self-Report Scale (version 1.0)

| ITEM | λ | *M* | *SD* |
|---|---|---|---|
| I have trouble concentrating on one thing at a time. | .83 | 2.13 | .91 |
| My mind wanders. | .70 | 2.62 | .93 |
| I have trouble keeping my thoughts organized. | .82 | 2.03 | .95 |
| I can't stick with thinks for more than a few minutes. | .46 | 1.84 | .91 |
| I lose track of what I am supposed to be doing. | .73 | 1.85 | .89 |
| I get distracted easily. | .81 | 2.42 | .91 |
| I tend to learn more slowly than I would like. | .46 | 2.09 | 1.03 |
| I have trouble organizing my schoolwork. | .63 | 1.80 | .90 |
| I am behind on my studies. | .49 | 2.10 | .80 |

**Big Five.** Personality was assessed using the Big Five inventory which includes 44 items to measure subscales of Neuroticism, Exraversion, Concientousness, Openness, and Agreeableness (John, Donahue, & Kentle, 1991). The Extraversion (versus Social Inhibition)

[4] Removed items included in Appendix C.

scale captures gregarious, energetic, and expressive features of behavior ($n$ = 8). The Agreeableness (versus Antagonism) scale reflects pro-social characteristics, describing the person who is empathic and makes an effort to establish positive relationships with others ($n$ = 9). The Conscientiousness (versus Lack of Direction) scale captures the multiple elements of persistence and impulse control in task and achievement settings ($n$ = 9). The Neuroticism (versus Emotional Stability) scale reflects multiple elements of negative emotionality, such as nervous tension, fearfulness, and brittleness under stress ($n$ = 8). The Openness to Experience scale refers to persons who are imaginative, curious, and creative ($n$ = 10). Each item was measured on a 5-point scale (1 = *Agree Strongly* to 5 = *Disagree Strongly*; midpoint = *Neither Agree or Disagree*). Items from each scale were averaged, with higher scores indicating higher levels of the personality trait.

For all 44 items, fit statistics indicated a poor fitting second-order model, $\chi 2$ (897) = 2640.84, $p < .01$, SRMR = .09, CFI = .66, RMSEA = .08 (90% CI: .07 .08). An additional factor structure previously recommended also was tested (DeYoung, 2006) but yielded fit statistics similar to the original conceptualization; therefore, the original structure was retained. After removing twenty-three items[5] due to high standardized residual covariance values or because of low loadings, the second-order model showed improved fit, $\chi 2$ (204) = 369.57, $p < .01$, SRMR = .06, CFI = .92, RMSEA = .05 (90% CI: .04 .06). However, internal consistency estimates were adequate for only four of the five subscales, ($\alpha > .70$), excluding Agreeableness. The remaining items in each dimension were averaged for total subscale scores, and complete statistics and items are included in Table 3.6.

[5] Items removed are included in Appendix C.

Table 3.6: Items and statistics for the Big Five Inventory

| ITEM | Avg. *r* | *α* | λ | *M* | *SD* |
|---|---|---|---|---|---|
| **Agreeableness** | **.28** | **.59** | .62 | 4.27 | .60 |
| Is generally trusting | | | .46 | 4.19 | .95 |
| Has a forgiving nature | | | .51 | 4.09 | 1.07 |
| Is considerate and kind to almost everyone | | | .41 | 4.34 | .82 |
| Starts quarrels with others | | | .80 | 4.46 | .74 |
| **Neuroticism** | **.45** | **.76** | -.42 | 2.68 | .88 |
| Remains calm in tense situations | | | .80 | 2.63 | 1.13 |
| Worries a lot | | | .58 | 3.22 | 1.30 |
| Is relaxed, handles stress well | | | .61 | 2.40 | 1.12 |
| Is emotionally stable, not easily upset | | | .71 | 2.45 | 1.04 |
| **Conscientousness** | **.36** | **.75** | -.71 | 4.37 | .57 |
| Does things efficiently | | | .81 | 4.41 | .70 |
| Perseveres until the task is finished | | | .62 | 4.62 | .64 |
| Is a reliable worker | | | .50 | 4.09 | .94 |
| Does a thorough job | | | .75 | 4.35 | .75 |
| **Extraversion** | **.52** | **.81** | .20 | 3.29 | .90 |
| Is outgoing, sociable | | | .69 | 2.90 | 1.15 |
| Is sometimes shy, inhibited | | | .82 | 3.31 | 1.20 |
| Tends to be quiet | | | .76 | 2.89 | 1.16 |
| Is reserved | | | .62 | 4.04 | .98 |
| **Openness** | **.35** | **.72** | -.31 | 3.53 | .71 |
| Is sophisticated in art, music, or literature | | | .89 | 3.61 | 1.01 |
| Is inventive | | | .49 | 3.86 | .95 |
| Is original, comes up with new ideas | | | .81 | 3.38 | 1.05 |
| Is ingenious, a deep thinker | | | .41 | 3.99 | .86 |
| Likes to reflect, play with ideas | | | .36 | 2.83 | 1.27 |

**Behavioral Inhibition.** The BIS/BAS instrument (Carver & White, 1994) is a self-report instrument comprised of 20 items divided into four factors scored on a 4-point response scale with no midpoint (*1 = Strong Disagreement* to *4 = Strong Agreement*). The measure has demonstrated convergent and divergent validity (e.g., Leone, Perugini, Bagozzi, Pierro, & Mannetti, 2001; Yu, Branje, Keijsers, & Meeus, 2011) with respect to variables such as introversion and neuroticism. The scales have also successfully predicted physiological responses according to the presented stimulus (either punishment or reward) (Carver & White, 1994), and researchers claim that, in general, evidence supports the contention that the

BIS/BAS scales reflect individual differences in the sensitivity of the presumed underlying neurophysiological regulatory systems proposed by Gray (1991) (Heubeck, Wilkinson, & Cologon, 1998).

Table 3.7: Items and statistics for the BIS/BAS Scale

| ITEMS | Avg. *r* | α | λ | *M* | *SD* |
|---|---|---|---|---|---|
| **BIS** | .30 | .75 | .31 | 2.91 | .50 |
| If I think something unpleasant is going to happen I usually get pretty "worked up." | | | .59 | 2.7 | .75 |
| I worry about making mistakes. | | | .69 | 3.0 | .71 |
| Criticism or scolding hurts me quite a bit. | | | .65 | 2.7 | .83 |
| I feel pretty worried or upset when I think or know somebody is angry at me. | | | .64 | 3.1 | .76 |
| Even if something bad is about to happen to me, I rarely experience fear or nervousness. | | | .45 | 3.0 | .76 |
| I feel worried when I think I have done poorly at something. | | | .45 | 3.2 | .67 |
| I have very few fears compared to my friends. | | | .40 | 2.5 | .77 |
| **BAS-D** | .51 | .81 | .55 | 2.91 | 56 |
| When I want something, I usually go all-out to get it. | | | .84 | 3.1 | .72 |
| I go out of my way to get things I want. | | | .82 | 2.9 | .74 |
| If I see a chance to get something I want, I move on it right away. | | | .74 | 3.0 | .63 |
| When I go after something I use a "no holds barred" approach. | | | .48 | 2.5 | .70 |
| **BAS-FS** | .49 | .78 | .31 | 3.00 | .56 |
| I will often do things for no other reason than that they might be fun. | | | .58 | 2.9 | .78 |
| I crave excitement and new sensations. | | | .77 | 3.2 | .69 |
| I'm always willing to try something new if I think it will be fun. | | | .76 | 3.3 | .64 |
| I often act on the spur of the moment. | | | .66 | 2.8 | .85 |
| **BAS-RR** | .46 | .80 | .95 | 3.58 | .41 |
| When I get something I want, I feel excited and energized. | | | .64 | 3.6 | .50 |
| When I'm doing well at something, I love to keep at it. | | | .75 | 3.7 | .50 |
| When good things happen to me, it affects me strongly. | | | .67 | 3.6 | .60 |
| It would excite me to win a contest. | | | .65 | 3.7 | .53 |
| When I see an opportunity for something I like, I get excited right away. | | | .67 | 3.4 | .65 |

NOTES: BIS = Behavioral Inhibition System; BAS-D = Behavioral Activation System-Drive; BAS-FS = Behavioral Activation System-Fun Seeking; BAS-RR = Behavioral Activation System-Reward Responsiveness

Two- and four-factor structures of the BIS/BAS have been examined and models prefer the original four-factor structure (Ross, Millis, Bonebright, & Bailley, 2002). Moreover, the four-factor model is invariant across countries including the United States, United Kingdom, and

Italy suggesting its generalizability (Leone et al., 2001). The four factors include the BIS scale, or punishment sensitivity which includes all items referencing reactions to the anticipation of punishment. In contrast to this unidimensional character of the BIS scale, there are three BAS-related scales. The Drive scale is made of items pertaining to the persistent pursuit of desired goals. The Fun Seeking scale has items reflecting both a desire for new rewards and a willingness to approach a potentially rewarding event on the spur of the moment. The Reward Responsiveness scale has items that focus on positive responses to the occurrence or anticipation of reward.

For all 20 items of the BIS/BAS scale, fit statistics indicated a good fitting second-order model, $\chi 2$ (166) = 361.18, $p < .01$, SRMR = .07, CFI = .91, RMSEA = .06 (90% CI: .05 .07). Internal consistency estimates were adequate for all subscales, and subscale scores were calculated individually; items and statistics are reported in Table 3.7.

**Manipulation Checks**

Manipulation checks were performed to establish that treatments were appropriately perceived, as indicated by audio distraction scores. Namely, the control condition (no stimulation introduced) should produce the lowest distraction scores, and high stimulation should produce the greatest distraction scores with moderate stimulation falling in-between. Initial examination of group means on audio distraction scores preliminarily supports this assertion: control group ($M$ = 1.85; $SD$ = .91), moderate stimulation ($M$ = 2.50; $SD$ = 1.28), and high stimulation ($M$ = 2.93; $SD$ = 1.25) (see Figure 3.1).

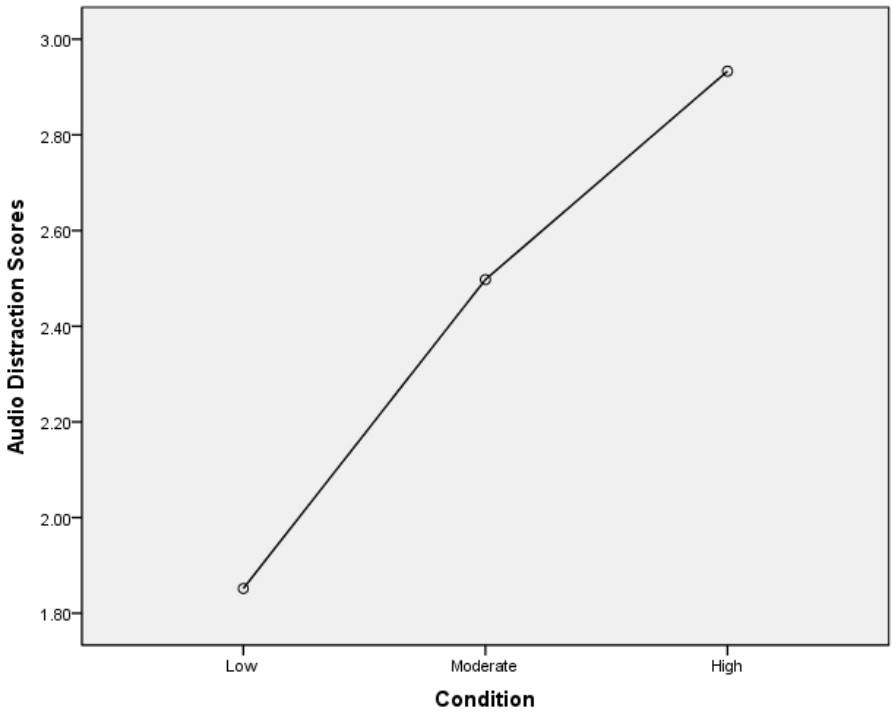



Figure 3.1: Audio distraction scores by stimulation intensity

Results of an *a priori* linear (polynomial) planned comparison (-3, +1, +2) indicated that the specified contrast weights were appropriately related to each group's audio distraction scores, $t$ (339) = 6.75, $p < .001$. Calculation of the $r_{effectsize}$, described as the correlation between individuals' observed scores and the contrast weights that reflect the predicted pattern of data, was identified as .34. Calculation of the $r^2_{effectsize}$, described as the proportion of total variation in audio distraction scores that is explained by the specified contrast, was identified as .13. Calculation of the $r_{alerting}$, described as the correlation between the observed group means and the contrasts weights reflecting the predicted pattern of group means, was identified as .90. The results of this test suggest that each condition demonstrated audio distraction scores in a linear pattern equivalent to the specified contrast weights. Thus, manipulations were correctly assessed, as those in the no stimulation condition reported the least amount of audio distraction

while the moderate treatment condition reported significantly more distraction than the no stimulation condition but less that the high stimulation condition.[6]

**Construct Validity**

In order to provide validity evidence for the SPS construct in this data set, bivariate correlations between SPS and a number of previously identified "related but not identical" (Aron & Aron, 1997, p. 361) constructs are examined. Personality constructs extraversion and neuroticism and measures of BIS/BAS reactivity are utilized for the analyses, and correlations can be found in Table 3.8.

Table 3.8: Bivariate correlations between validity variables and SPS

| | SPS | ADD | Extra | Neuro | Agree | Open | Consci | BIS | BAS | BASD | BASF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SPS | -- | .34* | -.39* | .71* | .06 | .01 | .14a | .73 | .17a | .04 | .03 |
| ADD | .29* | -- | -.12+ | .32* | -.04 | -.03 | -.41* | .20* | .04 | -.07 | .17a |
| Extra | -.32* | -.10 | -- | -.11+ | .13+ | .12+ | .13+ | -.11+ | .22* | .28* | .26* |
| Neuro | .56* | .26* | -.09 | -- | -.36* | -.12+ | -.25* | .77* | .06 | .04 | -.04 |
| Agree | -.04 | -.03 | .09 | -.24* | -- | .15a | .48* | .05 | .35* | -.02 | .04 |
| Open | .01 | -.02 | .09 | -.09 | .10 | -- | .29* | -.04 | .16a | .21* | .31* |
| Consci | -.11+ | -.33* | .10 | -.19* | .32* | .21* | -- | .00 | .31* | .28* | -.01 |
| BIS | .57* | .16+ | -.08 | .58* | .03 | -.03 | .00 | -- | .34* | .08 | -.04 |
| BASR | .14+ | .03 | .18* | .05 | .24* | .12+ | .24* | .26* | -- | .52* | .27* |
| BASD | .03 | -.06 | .23* | .03 | -.01 | .16a | .22* | .06 | .42* | -- | .33 |
| BASF | .02 | .14a | .21* | -.03 | .03 | .23* | -.01 | -.03 | .21* | .26* | -- |

NOTES: All correlations above the diagonal corrected for attenuation; * = $p < .001$; a = $p < .01$; + = $p < .05$; Agree = Agreeableness; Extra = Extraversion; Consci. = Conscientiousness; Neuro = Neuroticism; Open = Openness; BIS = Behavioral Inhibition System; BAS = Behavioral Activation System; BASD = Behavioral Activation System – Drive; BASF = Behavioral Activation System – Fun Seeking

Results of bivariate correlations in this study reflect previous findings of Smolewska et al. (2006) and provide evidence of convergent and discriminant validity for the SPS measure in these data. A variety of sources have previously found SPS related to the personality variables introversion and neuroticism (e.g., Ahadi & Basharpoor, 2010; Aron & Aron, 1997; Smolewska

[6] Differences between HSPs and non-HSPs on scores of audio distraction were also investigated. This information is included in Appendix E.

et al., 2006), and in this study SPS was found to be negatively and moderately related to the Big Five subscale of extraversion and demonstrated a strong positive relationship with neuroticism.

In addition, SPS has been theorized as emanating from systems of the brain described by Gray (1991) such as the BIS and BAS. Primarily, as presupposed by Aron and Aron (1997) and in consideration of the findings of Smolewska et al. (2006), SPS should be positively related to BIS and largely unrelated to the BAS subscales. Bivariate correlations support such a contention as BIS items demonstrated a strong, positive relationship with SPS. Furthermore, only the BAS-Reward Responsiveness subscale demonstrated any significant relation with SPS (identical to Smolewska et al., [2006]).

Overall, these findings coincide with previous validation studies (Aron & Aron, 1997; Smolewska et al., 2006) and support SPS as a temperament trait variable with multiple influences on human personality. SPS is characterized by a neurological disposition that is highly-reactive to adverse stimuli (BIS), which is consequently manifested by a personality type that is typically introverted and exceedingly emotional.

**Confusion Matrices and Test Means**

A series of comparisons and calculations were examined in order to determine any differences in accuracy judgments between modality tests or emotions. For example, inspections of the mean number of errors (Table 3.9) and hit rate accuracy (Table 3.10) were performed for each of the three modality tests (facial expression, body posture, and paralanguage). Across all tests, accuracy rates indicated greater than chance ability to identify the correct emotion (see Tables 3.10 and 3.11). Total mean scores indicate that the facial expression test recorded the fewest average errors, followed by postures and paralanguage. Independent samples t-tests were utilized to examine differences in error scores between HSPs and non-HSPs. Two significant

differences in the average number of judgment errors between HSPs and non-HSPs were identified, including faces $t$ (331) = 1.87, $p < .05$, and postures, $t$ (334) = 1.71, $p < .05$ (one-tailed significance tests) indicating significantly more errors for HSPs (see Table 3.9).

Table 3.9: Mean DANVA-2 errors by sensitivity and modality

| | Faces | | Voice | | Postures | |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| HSP | 6.16 | 2.65 | 5.84 | 2.34 | 6.75 | 2.48 |
| Non-HSP | 5.58 | 2.41 | 5.85 | 2.47 | 6.23 | 2.42 |
| Total | 5.74 | 2.49 | 5.85 | 2.43 | 6.37 | 2.44 |

Researchers have recommended that confusion matrices be reported when using non-verbal detection data (Scherer, Banse, Wallbott, & Goldbeck, 1991; Wagner, 1993). Therefore, Table 3.10 reports the number of errors as well as the number of correct responses. In addition to the raw frequency counts, the statistics H and $H_u$ are also presented. The hit rate, H, is the conditional probability that a stimulus is correctly identified (the number of hits divided by the number of stimuli of the target type). For example, in the facial expression test there were 1860 hits out of 2004 possible for happiness, thus accuracy of about 92%. $H_u$, the unbiased hit rate, takes simultaneous account of both stimulus and judge performance, thus it is an estimate of the joint probability both that a stimulus is correctly identified and that a response is correctly used (Wagner, 1993, p. 16).[7] Values for $H_u$ range between 0 and 1 with scores closer to 0 representing lower accuracy of judgment. $H_u$ scores between HSPs and non-HSPs are compared in Table 3.11. All table values can be compared to the level of chance that a participant would guess the correct response, .25.

[7] Further information detailing the differences between hit rate and differential accuracy, as well as the potential statistical confounds which are produced can be found in Wagner (1993).

Table 3.10: Confusion matrices for all tests of the DANVA-2 with total errors, *H*, and $H_u$

| **Faces** **Choice** | **Actual** | Happy | Sad | Angry | Fearful |
|---|---|---|---|---|---|
| Happy | (*n*) | 1860 | 63 | 416 | 393 |
| *H* | | .92 | | | |
| $H_u$ | | .63 | | | |
| Sad | (*n*) | 71 | 1467 | 132 | 136 |
| | | | .73 | | |
| | | | .59 | | |
| Angry | (*n*) | 20 | 343 | 1378 | 82 |
| | | | | .69 | |
| | | | | .52 | |
| Fearful | (*n*) | 53 | 131 | 78 | 1393 |
| | | | | | .70 |
| | | | | | .59 |
| **Posture** **Choice** | **Actual** | Happy | Sad | Angry | Fearful |
| Happy | (*n*) | 1681 | 58 | 412 | 509 |
| *H* | | .83 | | | |
| $H_u$ | | .53 | | | |
| Sad | (*n*) | 142 | 1785 | 236 | 78 |
| *H* | | | .89 | | |
| $H_u$ | | | .71 | | |
| Angry | (*n*) | 136 | 103 | 1303 | 274 |
| *H* | | | | .65 | |
| $H_u$ | | | | .46 | |
| Fearful | (*n*) | 57 | 70 | 65 | 1155 |
| *H* | | | | | .57 |
| $H_u$ | | | | | .49 |
| **Voice** **Choice** | **Actual** | Happy | Sad | Angry | Fearful |
| Happy | (*n*) | 1470 | 62 | 110 | 14 |
| *H* | | .73 | | | |
| $H_u$ | | .65 | | | |
| Sad | (*n*) | 126 | 1490 | 181 | 502 |
| *H* | | | .73 | | |
| $H_u$ | | | .48 | | |
| Angry | (*n*) | 312 | 76 | 1634 | 20 |
| *H* | | | | .82 | |
| $H_u$ | | | | .65 | |
| Fearful | (*n*) | 96 | 376 | 79 | 1468 |
| *H* | | | | | .73 |
| $H_u$ | | | | | .53 |

Table 3.11: Comparing $H_u$ values between HSPs and non-HSPs

| | Happy | Sad | Angry | Fearful |
|---|---|---|---|---|
| Faces | | | | |
| HSP | .62 | .55 | .52 | .53 |
| Non-HSP | .63 | .61 | .52 | .61 |
| Voices | | | | |
| HSP | .63 | .49 | .66 | .54 |
| Non-HSP | .66 | .48 | .65 | .53 |
| Postures | | | | |
| HSP | .52 | .70 | .42 | .45 |
| Non-HSP | .53 | .71 | .48 | .50 |

## Results

### Hypothesis 1

H1 stated that under normal conditions (i.e., without exposure to external stimulation) HSPs are more accurate at decoding the non-verbal facial, bodily, and vocal cues of posed social actors. Because images are shown for approximately two seconds, the tendency of HSPs to deeply process incoming stimuli should make them more perceptive of others' emotions.

In consideration of this hypothesis, independent samples t-tests were performed to examine whether highly sensitive people reported fewer accuracy errors than non-HSPs in the control condition. Dichotomized HSPS scores served as the grouping variable, and the dependent variable was the mean error scores for all three non-verbal decoding tests (facial expression, body posture, vocal paralanguage). Results indicated that there was not a significant effect for group differences regarding errors in either the facial, $t$ (100) = .05, $p$ = .96, $r^2$ = .01, bodily, $t$ (100) = 1.44, $p$ = .15, $r^2$ = .14, or vocal, $t$ (97) = -.17, $p$ = .86, $r^2$ = .02, decoding tasks. Positive $t$ values reflect a greater number of errors by HSPs, contrary to Hypothesis 1. In fact, only in the vocal cues test was the valence of the finding in the appropriate, hypothesized direction. No evidence in support of H1 was found, and it appears that HSPs are no more

accurate at recognizing the non-verbal cues of posed and recorded actors than are non-HSPs; in fact, sensitives may actually perform worse but these results fail to reach significance.

**Hypothesis 2**

H2 stated that highly-sensitive persons experience greater arousal when exposed to cues of moderate and high stimulation. In light of this prediction, several tests were performed to identify any possible differences between HSPs and non-HSPs with respect to their reported general distraction levels in moderate and high stimulation conditions. First, an omnibus ANOVA test of main and interaction effects was performed with stimulation condition and sensitivity as independent factors and processing distraction as the dependent variable (see Table 3.4 for items). Model statistics indicated main effects for sensitivity, $F$ (1, 342) = 7.94, $p < .01$, $\eta_p^2 = .02$, $\eta^2 = .00$, and stimulation condition, $F$ (2, 342) = 15.03, $p < .001$, $\eta_p^2 = .08$, $\eta^2 = .02$. Moreover, the sensitivity by stimulation intensity interaction was also present, $F$ (2, 342) = 3.33, $p < .05$, $\eta_p^2 = .02$, $\eta^2 = .00$.[8] Data plots in Figure 3.2 depict differences between HSPs and non-HSPs in the stimulation conditions, most apparent of which is in the high stimulation condition. Follow up t-tests were performed to investigate possible distraction differences between HSPs and non-HSPs in any of the stimulation conditions. Means for plots in Figure 3.2 are included in Table 3.12. Only a significant difference between the HSPs and non-HSPs in the high stimulation condition was found, $t$ (138) = 3.36, $p < .01$, $r^2 = .28$.

Second, planned contrasts tests utilizing the contrast weights -3, +1, +2 were compared for HSPs and non-HSPs. The contrast was an equivalent fit for both HSP, $t$ (87) = 2.67, $p < .01$, and for non-HSP, $t$ (249) = 2.68, $p < .01$. Values of the $r_{effectsize}$, described as the correlation between individuals' observed scores and the contrast weights that reflect the predicted pattern

[8] ADD was found to be correlated to the dependent variable, $r = .15$, $p < .01$. Thus, when ADD scores were added as a covariate to the model only the condition factor remained significant, $F$ (1, 83.93) = 5.57, $p < .01$, $\eta_p^2 = .12$, $\eta^2 = .02$. The effect for ADD was not significant, $F$ (31, 3.61) = 1.52, $p = .39$.

of data, $r_{contrast}$, described as the proportion of total variation in audio distraction scores that is explained by the specified contrast, and $r_{alerting}$, described as the correlation between the observed group means and the contrasts weights reflecting the predicted pattern of group means, are compared between HSPs and non-HSPs in Table 3.13.

Overall, HSPs report greater levels of general arousal than non-HSPs, across all conditions, with a significant difference located in the high stimulation condition. Planned contrasts equally reflect patterns of distraction scores for HSPs and non-HSPs. The results are largely supportive of H2 and provide evidence for Aron's (1996) claim that, "what is moderately arousing for most people is highly arousing for HSPS. What is highly arousing for most people causes an HSP to become very frazzled" (Aron, 1996, p. 7). Given several tests of the data, in this study, HSPs report thinking more about distractions and paying closer attention to the sights and sounds in the laboratory environment when exposed to high intensity audio stimulation, thus supporting the second part of Aron's (1996) claim about being "frazzled" (p. 7).

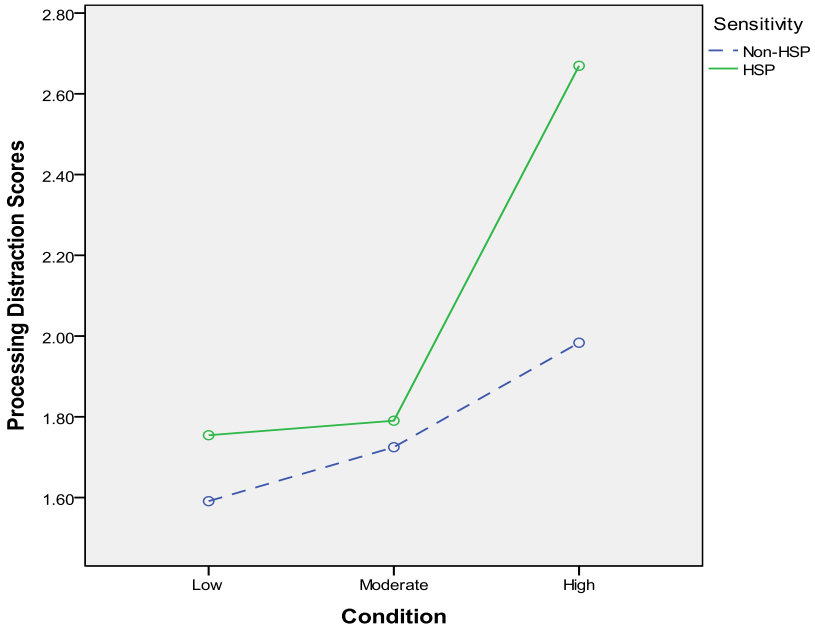



Figure 3.2: ANOVA, stimulation condition by sensitivity on processing scores

Table 3.12: Means of processing distraction scores by sensitivity and condition

| | HSP *M* (*SD*) | Non-HSP *M* (*SD*) |
|---|---|---|
| Control Condition | 1.75 (.79) | 1.59 (.73) |
| Moderate Condition | 1.80 (.74) | 1.72 (.82) |
| High Condition | 2.67 (1.35) | 1.98 (.89) |

Table 3.13: Planned contrast effect size comparisons

| | HSP | Non-HSP |
|---|---|---|
| $r_{effectsize}$ | .26 | .17 |
| $r_{contrast}$ | .28 | .17 |
| $r_{alerting}$ | .66 | .82 |

**Hypothesis 3**

H3 predicted that greater awareness of subtleties combined with deeper sensory processing negatively impacts HSPs' accuracy at decoding non-verbal cues when exposed to adverse stimuli. To test this assertion, HSPs and non-HSPs were compared for differences in accuracy scores regarding adult facial expressions, adult postures, and adult paralanguage across the three condition of stimulation. First, a multivariate ANOVA model was tested with stimulation condition and sensory-processing sensitivity as independent variables and error scores on facial, bodily, and vocal decoding tests as the dependent variables. Additionally, total accuracy scores for all subjects were computed by summing the errors for all three tasks to determine gestalt decoding accuracy. Results of the omnibus MANOVA test failed to reveal any significant interaction effect for sensitivity by stimulation for the linear contrasts (see Figures 3.3 through 3.6 for model statistics).

Since MANOVA is designed to detect effects for linear combinations of dependent variables, planned contrasts tests were used to investigate differences in patterns of errors between HSPs and non-HSPs on all four dependent variables separately. A planned contrast of -3, +1, +2 tested a linear increase in errors from control to moderate then high stimulation

conditions. Differences in contrast patterns were only identified for the facial expression test. Results indicated that the planned contrast was significant for HSPs, $t$ (85) = 1.81, $p < .05$, but not for non-HSPs, $t$ (242) = .78, $p = .22$. The non-finding of the specific contrast amongst the non-sensitives indicates that the pattern of errors is different between HSPs and non-HSPs. Visual inspection of means plots in Figure 3.3 shows a gradual linear pattern (but not statistically significant) for non-HSPs that clearly differs from the sharp increase in errors for HSPs. The magnitude of the effect is explained by the calculation of $r_{effectsize}$, described as the correlation between individuals' observed scores and the contrast weights that reflect the predicted pattern of data, which was identified as .14, for HSPs (.05 for non-HSPs). Calculation of the $r^2_{effectsize}$, described as the proportion of total variation in facial expression error that is explained by the specified contrast, was identified as .02. This number reflects $R^2$ values from the omnibus ANOVA tests.

Overall, results indicate support for H3 but only for the facial expression accuracy. When decoding facial expressions of emotion, HSPs are as accurate as non-HSPs in the control condition, but are significantly worse (i.e., more errors) in moderate and high stimulation conditions. In consideration of hypotheses, specified planned contrasts represented HSP error patterns more robustly than non-HSPs, but again only in the facial expression recognition test. No significant interaction effects between sensitvity and stimulation intensity on accuracy judgements were identified in the omnibus MANOVA test.

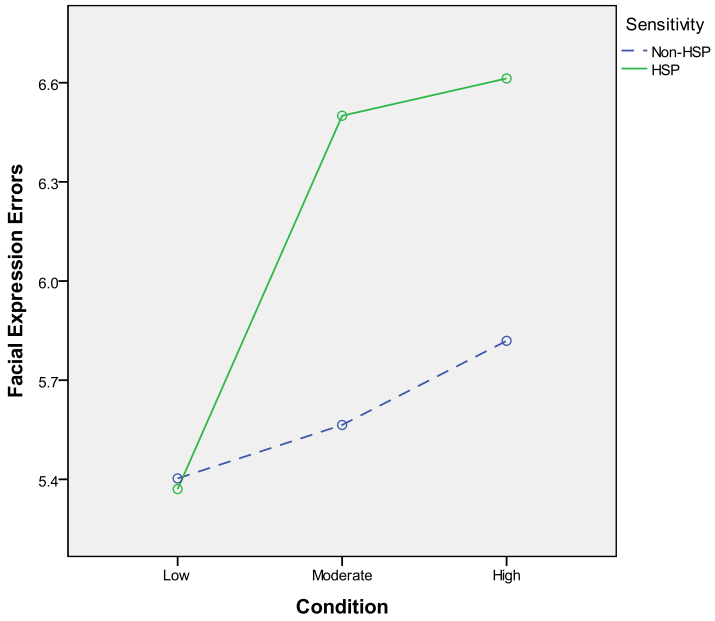



Figure 3.3: MANOVA, condition by sensitivity on facial errors

Condition: $F(1, 325) = 2.58$, $p = .08$, $\eta_p^2 = .02$, $\eta^2 = .02$

Sensitivity: $F(1, 325) = 3.25$, $p = .07$, $\eta_p^2 = .01$, $\eta^2 = .02$

Sensitivity * Condition: $F(1, 325) = .89$, $p = .41$, $\eta_p^2 = .01$, $\eta^2 = .02$

$R^2 = .03$

$F_{contrast} = .02$, $p = .88$ (equal *n*'s: $F_{contrast} = 1.53$, $p = .22$)

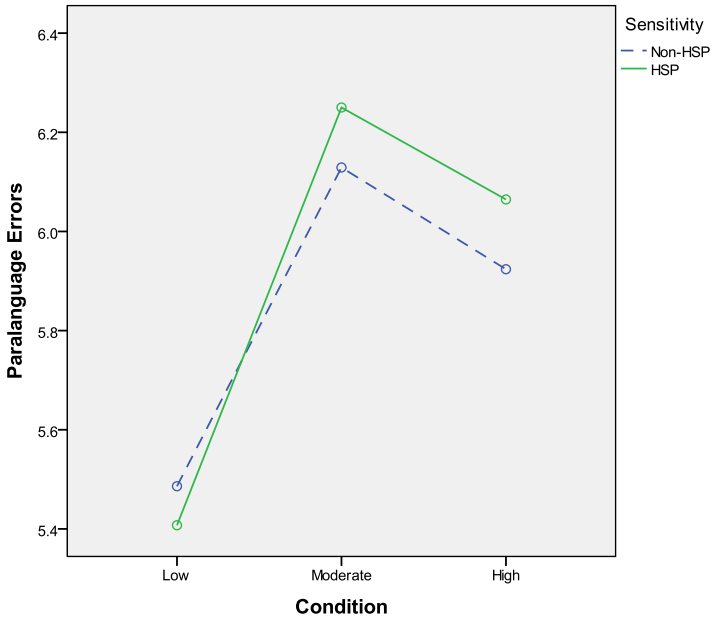



Figure 3.4: MANOVA, condition by sensitivity on paralanguage errors

Condition: $F(1, 325) = 2.02$, $p = .14$, $\eta_p^2 = .01$, $\eta^2 = .02$

Sensitivity: $F(1, 325) = .04$, $p = .84$, $\eta_p^2 = .00$, $\eta^2 = .02$

Sensitivity * Condition: $F(1, 325) = .05$, $p = .95$, $\eta_p^2 = .00$, $\eta^2 = .02$

$R^2 = .01$

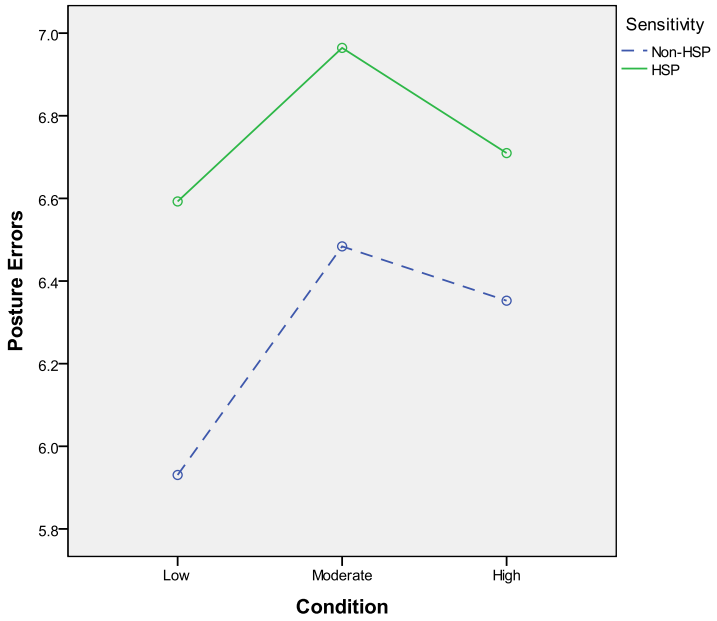



Figure 3.5: MANOVA, condition by sensitivity on posture errors

Condition: $F(1, 325) = .72$, $p = .49$, $\eta_p^2 = .00$, $\eta^2 = .00$

Sensitivity: $F(1, 325) = 2.64$, $p = .11$, $\eta_p^2 = .01$, $\eta^2 = .00$

Sensitivity * Condition: $F(1, 325) = .09$, $p = .92$, $\eta_p^2 = .01$, $\eta^2 = .00$

$R^2 = .02$

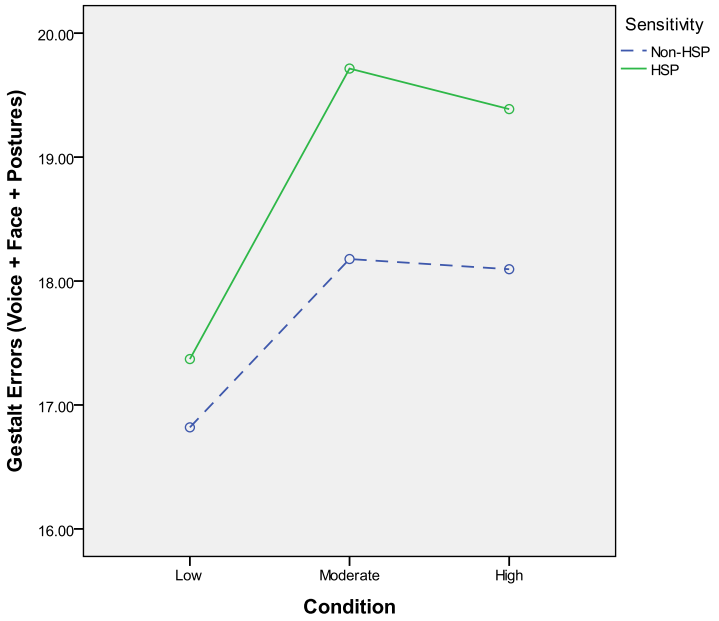



Figure 3.6: MANOVA, condition by sensitivity on gestalt errors

Condition: $F(1, 325) = 3.14$, $p = .05$, $\eta_p^2 = .02$, $\eta^2 = .00$

Sensitivity: $F(1, 325) = 3.01$, $p = .08$, $\eta_p^2 = .01$, $\eta^2 = .00$

Sensitivity * Condition: $F(1, 325) = .20$, $p = .82$, $\eta_p^2 = .00$, $\eta^2 = .00$

$R^2 = .03$

$F_{contrast} = .16$, $p = .69$ (equal $n$'s: $F_{contrast} = 9.97$, $p < .01$)

## Discussion

The primary aim of this experiment was to test three hypotheses related to specific facets of sensory-processing sensitivity, with particular attention afforded to HSPs' higher sensitivity to stimulation and deeper processing (Aron et al., in press, p. 6). These qualities are proposed to enhance inferential ability (H1), lead to greater amounts of distraction during moderate and high stimulation (H2), and cause HSPs to perform poorly on non-verbal decoding accuracy tests when exposed to adverse stimuli (H3). Overall, results failed to identify any distinction with respect to inferential accuracy, thus finding no support for H1; however significant differences between HSPs and non-HSPs regarding reported levels of distraction provide evidence in support of H2. Furthermore, means plots of error scores on facial expression recognition tasks reflected the proposed causal and interaction effects of SPS more closely than any other modality, providing partial support for H3 (see Figure 3.3). Although an effect of SPS is likely present, tests indicate that the effect size is very small thus difficult to detect statistically given the current sample. In general, however, a heightened awareness towards sensory information and a tendency to process this information more thoroughly likely have minimal consequences related the understanding of others' emotional expressions. Below, I detail five important findings.

The first finding is that HSPs appear to be more cognizant of their arousal and more attentive to their surroundings during all conditions, suggested because HSPs notice more sensory stimuli, "pause and check" them out, and process subtle stimuli for longer durations. Two patterns support such a claim, namely the visual differences depicted in Figure 3.2 that shows higher levels of general distraction, and also the patterns shown in Figure AE.1 (see pg. 154). In both plots, HSPs demonstrate higher levels of distraction across all stimulation conditions, although not all differences were statistically significant. Given these two patterns it

seems appropriate to suggest that HSPs are more susceptible to adverse effects of stimulation, in particular a tendency to become more distracted by audio stimulation, in these data. Visual evidence indicates HSPs also are more distracted than non-HSPs in the control condition, although this finding was not supported statistically. This might be the case because the laboratory setting or the prospect of being evaluated on a test were more stimulating for HSPs than non-HSPs. Indeed, encountering novel situations or being evaluated by others are sources of arousal for HSPs (Aron, 1996; Aron & Aron, 1997). These types of uncontrollable stimuli may play a role in explaining greater levels of distraction for HSPs and are possible limitations of the study. Future research should attempt to account for these possible spurious factors.

A second important finding is that HSPs were not more accurate at recognizing the facial, bodily, or vocal expressions of actors in the control condition. Better accuracy for HSPs was predicted because deeper processing of stimuli is thought to allow for greater discrimination between similar or subtle cues (Jagiellowicz et al., 2011). Independent samples t-tests failed to indicate significant group differences by accuracy scores of HSPs and non-HSPs. In fact, results indicated that in the control condition HSPs may actually be worse at detecting emotions, a finding that may relate to feelings of being evaluated. HSPs are believed to be particularly sensitive to and become highly aroused in situations where they understand they are being watched (Gearhart & Bodie, 2012), which is also indicated in an item in the HSPS (Aron & Aron, 1997). It appears that HSPs are no more accurate than non-HSPs when deciphering expressions of emotion when not exposed to stimulation; however, this does not necessarily mean that increased processing in the brain is not occuring.

There may be two possible explanations for the inability to identify differences in accuracy between HSPs and non-HSPs in the control condition. First, it should be noted that the

fMRI study results (Jagiellowicz et al., 2011) also failed to identify any differences in accuracy between HSPs and non-HSPs. Although brain activation patterns were different when making judgments between minor change landscape images, HSPs were no more accurate at detecting whether a change occurred than non-HSPs. Also, it may be that the two-second period of reflection may have attenuated any differences. These two plausible explanations for the non-significant results prompt future research to investigate shorter display times, for instance.

The third major finding is adverse stimulation contributed to poorer performance on all measures of non-verbal decoding accuracy for both HSPs and non-HSPs. This was predicted for HSPs because they are more highly reactive to stimulation, and physiological arousal contributes to differences in attention and cognitive ability (Goffman, 1990). Although the impact of stimulation was expected to be more drastic and detrimental on HSPs accuracy scores, results indicated that, regardless of modality or stimulation condition, differences in errors between HSPs and non-HSPs were not statistically significant. That is to say, HSPs were not significantly worse that non-HSPs on either facial, vocal, or posture recognition tests when exposed to moderate or high stimulation.

The predicted effects for HSPs seem to be represented in the facial expression detection task, although not all differences are statistically significant. Planned contrasts tests indicated that predicted error patterns (-3, +1, +2) were different between HSPs and non-HSPs, suggesting that this prediction better explained the facial expression accuracy scores of HSPs than non-HSPs. This finding is interesting because, as demonstrated in the in the error means (see Table 3.9), facial expression recognition achieved the highest level of accuracy. Therefore, because accuracy judgments are more likely to be correct the errors made by HSPs are more dramatic and significant. HSPs average one more error on the facial expression test (out of possible 24) across

both stimulation conditions than non-HSPs. Although the interaction effect of sensitivity and condition was not statistically significant, visual patterns in Figure 3.3 reflect predictions nicely. Ultimately, finding non-significance for the omnibus ANOVA and independent samples t-tests are likely artifacts of power and sample size, thus more insight should be gleamed from the differences in planned contrasts tests between HSPs and non-HSPs in the facial expression decoding test.

In general, error score plots in Figures 3.3 to 3.6 reflected the *a priori* theoretical propositions made at the outset of this study. That is, HSPs were worse than non-HSPs when exposed to stimulation. Unfortunately, interaction effects were too small to detect in the current sample (approximately 2-3% of variance explained). Differences in sensitivity and condition are statistically non-significant and seemingly practically insignificant as well; in fact, differences in errors between HSPs and non-HSPs were only to the magnitude of approximately 1.5 more errors per 72 responses. While the numbers certainly do not reflect a large influence of SPS on inferential accuracy, it seems that, across all modalities, when stimulation is introduced the highly sensitive participants fare slightly worse than non-sensitives. If a different outcome variable were considered, such as evaluations of reading or listening comprehension, then effects may be more profound. Emotional expression detection, it appears, is a rather strong ability or skill of healthy participants regardless of sensitivity levels.

Finally, an interesting finding to remark upon is that Figures 3.3 through 3.6 shows that moderate stimulation has a slightly more negative influence on error scores than high stimulation. This pattern seems to be consistent across HSPs and non-HSPs. Thus, although subjects reported the greatest distraction under high stimulation, visual inspection of DANVA-2 errors showed a leveling off or decrease between the moderate and high stimulation conditions,

which is particularly evident in the postures, paralanguage, and gestalt means plots. These findings suggest that people are, seemingly, equivalently bothered by moderate and high stimulation, or, possibly even more bothered by moderate stimulation. Constant stimulation in the high stimulation condition possibly becomes less of a nuisance and more of a "white noise" to which subjects are better able to prepare, adjust, or adapt. The paradox that participants reported more distraction when exposed to high stimulation but showed a lesser detriment to performance (i.e., fewer judgment errors) than those exposed to moderate stimulation is fodder for future research.

**Limitations**

There are a number of limitations surrounding the current study. The first is the measure of SPS itself, the second is the lack of power to detect small effects given the current sample size, and the third is the fact that HSPs may be more bothered by laboratory conditions.

First, problems with the measurement of SPS via the HSPS are glaring. Aron et al. (in press) make it clear that SPS is more than simply sensitivity to stimulation. The authors of the construct go through pains to clearly mark SPS as having negative qualities (e.g., overstimulation) as well as positive qualities (e.g., increased discriminatory ability, increased conscientiousness). These two orthogonal qualities of SPS cause confusion and difficulty when SPS is operationalized and measured as a one-dimensional construct.

Indeed, criticisms have been leveled against the originally proposed unidimensional structure of the measure on grounds that other models of trait SPS fit those data better therefore providing a more specified operationalization of the construct (e.g., Smolewska et al., 2006). Recent confirmatory factor analyses regarding the single factor structure of the HSPS have been largely unimpressive with comparative fit indexes around .60 - .75 (Gearhart, 2011; Gearhart &

Bodie, 2012). More problematic is that when items are removed from the HSPS measure to produce a better fitting representation, items that are necessary for removal are consistently those that reflect the positive qualities of SPS (see Appendix C). For instance, it is interesting to note that in this study the items removed from the unidimensional scale were those that reflected the positively valenced aesthetic sensitivity subscale proposed by Smolewska et al. (2006). Aesthetic sensitivity (AES) refers to a person's level of aesthetic awareness (e.g., Do you seem to be aware of subtleties in your environment?). After removing AES items, what was remaining, then, were items that only assessed and reflected the negative consequences of SPS such as being easily overstimulated and sensitivity to loud noises (see Table 3.3).[1] Future research should continue to examine the SPS instrument to modify the scale to best reflect the orthogonal domains of SPS, which may ultimately increase the likelihood of adequate reliability estimates and help to maintain consistency across studies.

The second limitation concerns the sample utilized in this study which, although including an adequate number of total participants, was unable to gather enough highly sensitive participants to maintain equal group sizes. The study, thus, was underpowered to detect small effects. First, because of time considerations and the relatively small population percentage suggested by E. N. Aron and Aron (1997), only approximately half of the required HSPs were obtained. Although data was collected during two semesters and a summer session for more than 120 hours, another 300 participants would likely be required to gather the recommended 54 HSPs per cell. Even if such a sample was acquired, results tend to indicate that the effect size of SPS on the dependent variables of interest is negligible at best. Typically, effect sizes reported for distraction measures and accuracy scores are between 1 and 3 percent of variance accounted

[1] While one might speculate this is a product of the method, the purpose of the study was to manipulate overstimulation, so I remind the reader that the HSPS was given prior to the laboratory part of the study when it was not clear to participants whether they would (or would not) encounter distraction.

for by sensitivity, a result which seems to be difficult to detect given the current sample size. G*Power 3.1 recommends a sample size of more than 17,000 to have adequate enough power (> .95) to detect these types of interaction effects (.05) (Faul et al., 2009).

The final limitation is the difficulty in extracting what portion of distraction scores are represented by HSPs' general tendency towards arousal in novel situations versus the influence of the treatment. When HSPs encounter novel situations they experience greater arousal (Aron, 1996), and as Figures 3.2 and AE.1 demonstrate, even without stimulation in the control condition HSPs report greater levels of distraction than non-HSPs. Thus, although it is apparent that the introduction of stimulation is noticed by HSPs and considered bothersome, there also exists evidence that without stimulation HSPs afford greater attention to, are more cognizant of and distracted by thoughts regarding their current environment and surroundings. Despite this limitation and those highlighted above, a number of conclusions can be gleamed from this study.

## Conclusion

Study one sought to examine the belief that HSPs demonstrate "greater awareness of sensory stimulation, so that more subtleties are noted, but overstimulation is also possible" (Aron, et al., in press, p. 6). Results of the current study indicate that HSPs and non-HSPs are equivalent in non-verbal decoding accuracy scores *ceteris paribus*, and the introduction of moderate and high stimulation caused a greater number of recognition errors by HSPs and non-HSPs. Generally speaking, HSPs appeared to be more distracted by their environment and stimuli, and demonstrated a higher number of errors across all test modalities when exposed to stimulation. Predicted effects for HSPs were most clearly identifiable in the facial expression detection test, although the magnitude of the effect of trait SPS was statistically non-significant and practically negligible.

# CHAPTER FOUR

# STUDY TWO

The purpose of study two is to investigate the effects of sensory-processing sensitivity on relationship satisfaction and affect management behaviors such as listening and emotional expressivity. The specific focus is on highly sensitive men because of previously suggested prosocial behaviors thought to be associated with higher sensory-processing sensitivity (SPS) in American society. Aron (2000) claimed that highly sensitive men (HSM) are different from non-HSM because as a highly sensitive man "you seem to be a person who shows your feelings—something not done by those who must always be in control" (p. 54), and this is believed to be "potentially very good for your relationships" (p. 50). Higher levels of sharing and understanding are thought possible because highly sensitive relational partners are more aware and expressive of their emotions (Aron, 1996), and previous research finds they are better listeners (Gearhart, 2011). However, the emotional sharing propensity for HSM also is believed to cause troubles due to their non-conformity to traditional American norms of masculinity causing HSM to be seen as "feminine" (Aron, 2000, p. 50). These speculations, however, remain empirically undocumented. Therefore, this study investigates heterosexual couples in order to determine the possible consequences of high SPS on HSM's affect management behavior and their partner's perception of relationship satisfaction.[1] Below, I detail a series of hypotheses that operationalize several propositions from Chapter Two with specific attention afforded to the influence of SPS on men's feelings of masculinity and women's perceptions of relational behaviors.

[1] It is acknowledged that homosexual couples are an important demographic group to study; such a focus is beyond the scope of this dissertation and would necessitate a large enough sample of couples to draw comparisons. Time and sample limitations prevent this possibility; however, see Aron (2000) about HSM in homosexual relationships.

## HSM Are Not "Real Men"?

Aron (2000) states, as a matter of fact, that by the American societal standards of masculinity, "a highly sensitive man is not a 'real man'" (p. 50). Her logical claim is that American men are socialized to be less expressive of their own emotions, less attentive to the emotions of others, and more competitive and reckless, behaviors which have been previously evidenced in peer-reviewed publications (e.g., Bem, 1974; Mahalik et al., 2003). The implication is that HSM are comparatively more expressive of emotions, more attentive to the feelings of their partners, more cooperative, and less active and outgoing (Aron, 2000, p. 55). Taken to its logical end, HSM are perceived as more "feminine" by others and society, a feeling that is then internalized, thereby causing HSM to experience less identification with the masculine identity and experience greater gender role stress for not meeting societal standards (Aron, 2000, p. 54). To date, however, there is no evidence to back any of these claims. Thus, it remains an empirical question whether HSM are more expressive, more attentive to the feelings of their partners, and less identified with the masculine gender role. More importantly, perhaps, no real mechanisms have been proposed to explain these conjectures, but objective self-awareness theory may be one partial starting point (Duval & Wicklund, 1972).

### Self-Awareness

Objective-self awareness (OSA) is "when attention is directed inward and the individual's consciousness is focused on himself, he is the object of his own consciousness—hence 'objective' self awareness" (p. 2).[2] The process of self-awareness is comprised of views of one's self, perceptions of societal standards, and the extent to which one meets those standards. Focusing attention on one's behaviors brings about objective self-awareness, which

[2] I am aware of the gender-bias represented in this quote, but note that the construct of OSA concerns men's self-awareness of their representativeness (or lack of) to American masculine ideology. Also, because the focus of this study is on HSM, such bias seems appropriate.

initiates an automatic comparison of the self against social standards. If a discrepancy is found between self and standards, negative affect should arise. This aversive state then motivates two behavioral routes: 1) actively change actions, attitudes, or traits to be more congruent with the representations of the standard; or 2) avoid the self-focusing stimuli and circumstances (Duval & Wicklund, 1972). Avoidance effectively terminates the comparison process and hence all self-evaluation.

The sensitivity to stimuli characteristic of SPS has been conceptualized as having multiple features, including perceptual sensitivity which reflects a greater awareness of feelings and arousal within the body, and associative sensitivity, a greater awareness of cognitions, or "thinking about thinking" (Aron, 1996, p. 11). Indeed, a defining characteristic of SPS is a "sensitivity related to imagination" (Evans & Rothbart, 2008, p. 109) and a "greater consciousness of self" (Aron & Aron, 1997, p. 349-350). Greater sensitivity to internal cognitions and states seems to be intimately linked with one's self-awareness, making highly sensitive persons more self-aware, thereby causing HSM to make more frequent comparisons to social standards. Because they are believed to be more feminine, HSM should experience greater discrepancy and negative feelings. For HSPs, negative affect resulting from heightened self-awareness is evidenced by the strong relationships that SPS shares with traits like neuroticism that reflect worry and self-doubt (e.g., Aron & Aron, 1997). From the perspective of OSA theory, if HSM are more aware of comparing their behavior to societal standards, and if they consistently fail to meet expectations because of their seemingly inherent feminine nature (Aron, 2000), then they can either conform to masculine standards more rigidly or they can avoid social interactions or instances in which comparisons will be discrepant. As such:

H1: Highly sensitive men report greater conformity to masculine norms than non-sensitive men.

Furthermore, a stronger desire to conform to masculinity standards, which necessarily entails a loss of self, would likely lead to greater gender role stress. Gender role stress has been a construct of interest to gender scholars for more than 25 years and is often studied through the Gender Role Conflict Scale (GRCS; O'Neil, 2008; O'Neil, Helms, Gable, David, & Wrightsman, 1986). Gender role conflict is defined as a psychological state in which socialized gender roles have negative consequences for the person or others, and it is experienced when restrictive gender roles result in constraint, devaluation, or violation of others or self (O'Neil, Good, & Holmes, 1995). Gender role conflict (GRC) can result from deviation from or violation of gender role norms, trying to meet or failing to meet gender role norms, experiencing discrepancies between actual and culturally ideal self-concepts, and experiencing personal stress for conforming to masculine ideology (O'Neil, 2008). In sum, "the personal experience of GRC constitutes the negative consequences of conforming to, deviating from, or violating the gender role norms of masculinity ideology" (O'Neil, 2008, p. 363). Any of these sources of GRC stress are likely to exist for HSM due to their inherent tendency to prefer "feminine" ways of communicating, behaving, and feeling according to Aron (2000). Therefore,

H2: Highly sensitive men report greater gender role stress than non-sensitive men.

The link between gender conformity and gender role stress espoused in the Gender Strain Paradigm (Pleck, 1995) suggests the possibility of a causal model depicting the relations of conformity to masculine norms and gender role conflict and stress. This paradigm asserts that conformity to norms causes greater gender role stress. Thus, this study tested the fully mediated model presented in Figure 4.1 against a partially mediated model whereby both SPS and conformity to masculine norms independently influence levels of gender role conflict and stress.

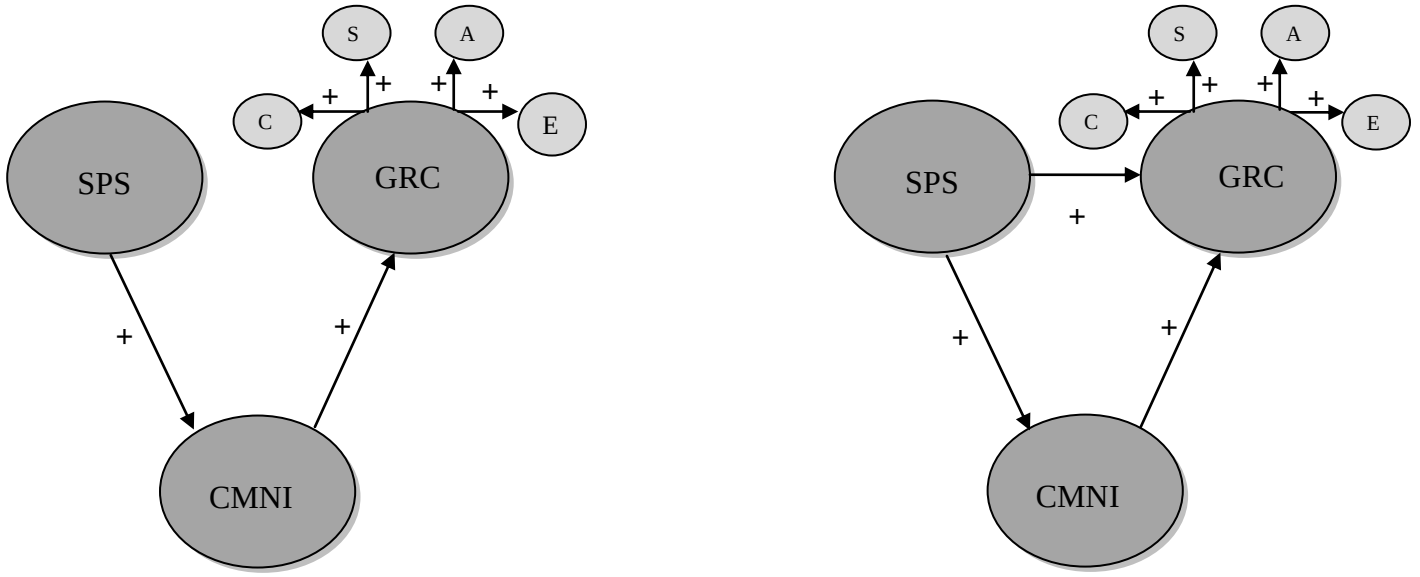



Figure 4.1: Proposed path models: SPS, CMNI, and Gender Role Stress

Figure 4.1 Notes: SPS = Sensory-processing sensitivity; CMNI = Conformity to Male Norms; GRC = Gender Role Conflict Scale; C = Conflict Between Work and Family; S = Success, Power, and Competition; A = Restricted Affectionate Behavior between Men; E = Restrictive Emotionality.

## Relational Consequences

Apart from the individual consequences for HSM described above, relationships and relational partners are likely affected by their male partner's SPS. HSM are considered more feminine because they engage in non-masculine behaviors (i.e., expressing their emotions), but the question remains if HSM truly engage in these types of behaviors. That is, even though HSM may identify less with masculine stereotypes (and more with those linked to femininity) (Aron, 2000), it is still an open question of whether this suggested feminine identification translates to changes in actual behaviors (e.g., listening, emotional expression).

If HSM do engage in such behaviors, then they can be considered more emotionally intelligent (Salovey & Mayer, 1990), which is defined as the ability of people to "monitor their own and others' emotions, discriminate among them, and use the information to guide their thinking and actions" (p. 189). Given HSM's higher perceptual sensitivity and deeper processing abilities, it seems that they should be more emotionally intelligent, and produce greater relational quality (Ciarrochi, Chan, & Caputi, 2000). Therefore, the influence of SPS on men's affect management behaviors will be considered, with special attention to emotional expression and listening. Utilizing the concept of emotional intelligence as a predictive framework, a series of hypotheses predicts the influences of SPS on the communicative behaviors of HSM in relationships, and subsequently the influence on satisfaction.

### Emotional Reactivity and Deeper Processing

Higher emotional reactivity and a greater depth of processing have positive influences on relationships. For example, HSM are more expressive of their own emotions, and they demonstrate a greater awareness and attention to the emotions of others.

**Self-expression.** First, greater emotional reactivity causes HSPs to more easily experience emotions, a quality which motivates HSM to talk about them. "It seems quite reasonable that sensitive persons should be more emotional, as they are aware of more and are more easily overaroused " (Aron & Aron, 1997, p. 363), and a likely way to soothe emotions is through talk. The quality of greater emotional reactivity leads HSM to enjoy deep conversations about their self-reflections (Aron, 2000), and HSM "like to talk about complicated things like feelings and struggles" (p. 101), and because they more readily show feelings and are more open with their emotions than their non-sensitive counterparts HSM are viewed as feminine (Aron, 2000). Driving the increased emotional sharing, then, are the neurotic qualities of HSM which reflect greater emotional reactivity, thus much of the sharing is negative, which includes those socially inappropriate leakages of negative emotions such as shame, definsiveness, criticism, or guilt (Gottman, 1990). In fact, people high on neuroticism are more likely to express negative emotions (Gross & John, 1994). It may be that greater emotional reactivity causes HSM to be more emotional and neurotic, and as such HSM are less able to edit or modify their behavior because of higher arousal (Gottman, 1990). Therefore, more expressions of negative emotion are likely to occur, and the following hypotheses are set forth:

H3: Partners report HSM perform less editing of messages than non-HSM.

H4: Partners report HSM perform greater sharing of negative affect than non-HSM.

**Aware of the Needs of Others.** HSM are more adept at meeting their relational partners needs because "thanks to [their] spontaneous deep processing, [HSM] can sense what will happen if other's don't receive what they need" (Aron, 2000, p. 56). Due to deeper processing, HSM are able to "pick up on much more of the subtle cues, the nuances" (p. 156) and "greater awareness of the subtle tends to make [them] more intuitive" (p. 7) to their partners thoughts and

feelings. HSM are sensitive to what others are not saying and aware of what others imply but do not say which is to say that they are able to "sense" the emotions of another person and listen more "empathically" than non-HSM (Aron, 2000, p. 174; Gearhart, 2011). HSM, then, have their own skills, as suggested by Aron (1996), such as "talking seriously, listening well, and allowing silences in which deeper thoughts can develop" (p. 104).

Indeed, listening behaviors as measured by a scale of active-empathic listening were found to be related to higher SPS (Gearhart, 2011). Moreover, Gearhart (2011) indentified a positive relationship between sensitivity and self-reported empathy, $r = .33$, and this relationship was being driven by highly sensitive persons' greater empathic listening ability. Listening ability is also reflected in verbal responses such as paraphrasing and asking questions (Bodie, St. Cyr, Pence, Rold, & Honeycutt, 2012). Thus, verbal responding through feedback should also be influenced for HSM. Therefore, if HSM more deeply process the messages of others by sensing implied meanings and empathically listening, and if HSM offer more verbal feedback, then relational partners should report feelings of being listened to and understood. As such:

H5: Partners report HSM are better listeners than non-HSM.

H6: Partners report HSM offer greater feedback than non-HSM.

Aron et al. (in press) pondered whether "being affected more by another's mood (also an item [in the HSP Scale]) lead[s] to greater empathy" (p. 16). Higher emotional reactivity, as well as enhanced active-empathic listening abilities, are thought to make HSM more concerned for the feelings of people around them. In fact, evidence shows that HSPs are more likely to report experiencing empathy when witnessing the unequal or mistreatment of others, which is to say they demonstrate greater emotional concern (Gearhart, 2011). HSPs experience greater levels of physiological and cognitive arousal when seeing distressed others, which contributes to

heightened feelings of sympathy and empathy. Indeed, Aron (1996) suggests that HSPs are less able to watch violent media content because of their emotional reactivity and concern for others. Demonstrating greater concern for and understanding of the emotions of others (i.e., empathy) has been found to increase levels of relationship satisfaction (e.g. Davis & Oathout, 1987). Thus,

H7: Partners of HSM will report greater relationship satisfaction than partners of non-HSM.

The link between prosocial relational behaviors like listening and greater relational satisfaction has been previously identified (see Bodie, 2012), which suggests the possibility of a causal model depicting the relations of behaviors like listening and relationship satisfaction. This is predicted in light of the construct of emotional intelligence, which explains that people of higher emotional intelligence are better able to manage their moods, which contributes to higher relational quality (Ciarrochi et al., 2000). A model is proposed whereby SPS and relational satisfaction are uncorrelated and thus MADS subscales mediate the relationship between SPS and relationship satisfaction. Thus, this study tested the model presented in Figure 4.2.

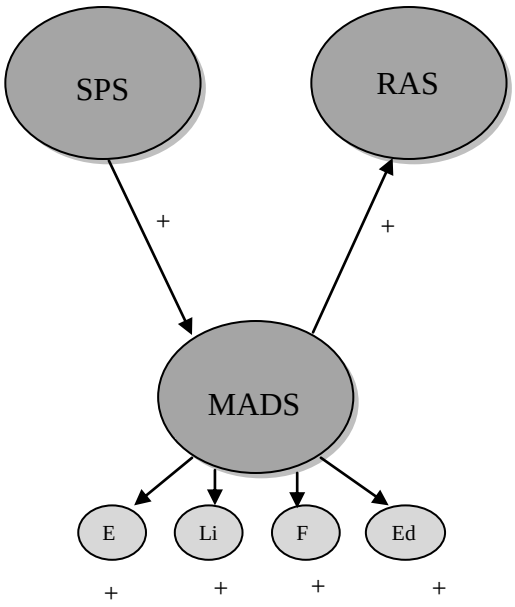



Figure 4.2: Proposed path model: SPS, MADS, and relationship satisfaction

Figure 4.2 Notes: SPS = Sensory-processing sensitivity; MADS = Managing Affect and Differences Scale; E = Expressing; Li = Listening; F = Feedback; Ed = Editing; RAS = Satisfaction.

## Method

### General Setup

Biological males in Communication Studies classes at Louisiana State University who were in committed romantic relationships for three months or more were recruited to complete an online survey about their feelings of masculinity and gender stress. Each biological male participant was also asked to allow his relational partner to be contacted in order to complete an online study about his relationship behaviors.

### Participants

A total of 162 respondents completed the online survey, which included a total of 81 male and 81 female participants. Eighty-one total heterosexual couples participated in the survey and reported an average relationship length of 26.27 months (*SD* = 23.95). Participants (i.e., males) reported a mean age of 21.07 (*SD* = 4.61) years and primarily Caucasian ethnicity (*n* = 78). Other race/ethnicities were marked including African-American (*n* = 1), Asian-American (*n* = 4), Hispanic/Latino/Chicano (*n* = 1), and Native America (*n* = 1). All class ranks were represented, Freshman (*n* = 17), Sophomore (*n* = 24), Junior (*n* = 23), Senior (*n* = 19), and Other (*n* = 1). Though male participants were gathered from a convenience sample of Louisiana State University students enrolled in Communication Studies courses, 9 (out of a possible 17) academic programs were represented.

Partners (i.e., women) reported a mean age of 19.96 (*SD* = 2.04) years and primarily Caucasian ethnicity (*n* = 68). Other race/ethnicities were marked including African-American (*n* = 3), Asian-American (*n* = 7), and Hispanic/Latino/Chicano (*n* = 4). Most of the females respondents reported being in college (*n* = 68).

Male students currently in romantic relationships were recruited for the study via an online scheduling system whence they were able to select from a variety of research credit opportunities. Males (i.e., participants) were chosen to initiate the research process because the nature of the survey necessitated a substantially greater time burden on their part. In particular, participants were required to respond to an additional 80 items regarding their gender role conflict and conformity to masculine norms that were not asked of females (i.e., partners). Additionally, previous research has found that females are more likely to respond to web-based surveys than are men. In an experiment to compare mailed versus web survey response rates, Sax, Gilmartin, and Bryant (2003) found that, "the strongest predictor of response across all modes of administration was gender [sic]. Regardless of whether [the survey] was administered via paper, Web, or some combination of the two, women responded at much higher rates than did men" (p. 424). This result is consistent with the work of Underwood, Kim, and Matier (2000) and offers support for the belief that women would be more likely to respond to the survey without incentive to do so.

Furthermore, survey requirements dictated that participants must be currently involved in a romantic relationship of longer than 3 months. This time frame was chosen because it represents an adequate amount of time to accurately answer questions about partners' relationship behaviors. Several studies have utilized the same time frame (e.g., Lipsky, Caetano, Field, & Larkin, 2006; Mullett & Stolberg, 2002). Thus, only male students currently in romantic relationships of longer than 3 months enrolled in Communication Studies classes that required research participation were permitted to complete the survey. Phone calls were placed to a random 10 percent of partners to verify that they were actual partners of male respondents, and all answered calls ($n$ = 7) confirmed the relationship. All male students received a small

amount of required research credit (1.5% of course grade) for their participation; however, relational partners were offered no incentives. All data collected were confidential, all students provided informed consent, and all procedures were approved by the LSU Institutional Review Board for human subjects (see Appendix H).

G*Power 3.1(Faul, Erdfelder, Buchner, & Lang, 2009) was utilized to determine sample size requirements necessary to identify group differences in independent samples t-tests. In order to find medium effects (.50) at the .05 significance level, the total number of couples should be 176 with at least 88 couples included in each of the two groupings (HSP vs. non-HSP). Unfortunately, time limitations prohibited the collection of a large enough sample size to yield the recommended number of highly sensitive participants, thus inhibiting the ability to detect statistically significant differences.[1] Table 4.1 presents the segmentation of the participants.

Table 4.1: Number of couples by sensitivity

| | |
|---|---|
| Non- HSP couples | 65 |
| HSP couples | 19 |
| **TOTAL** | 84 |

**Procedures**

First, male students completed an online survey in which they were administered several individual difference scales, including the Highly Sensitive Persons Scale (HSPS; Aron & Aron,1997), the Relationship Assessment Scale (Hendrick, 1988), the Conformity to Male Norms Inventory (Mahalik et al., 2003), the Gender Role Conflict Scale (O'Neil et al., 1986), as well as basic demographic information. There were a total of 155 items on the online survey, which took male respondents an average of about 12 minutes to complete. Next, male students provided contact information for their relational partner including an email address and phone number.

[1] Data were collected for from January 23rd, 2012 to May 1st, 2012.

Relational partners (typically females) were then solicited via email to participate which included information regarding the survey purpose, the confidentiality of their results, and a direct link to the survey page. The email sent to relational partners can be found in Appendix F. Relational partners completed questions regarding their relationship satisfaction as well as other-report questions regarding their male partners' affect management behaviors (via the Managing Affect and Differences Scale). Male students were administered research credit only after their partner completed the survey.

**Measures**

**Highly Sensitive Persons Scale.** The Highly Sensitive Persons Scale (Aron & Aron, 1997) asks participants to respond to 27 statements regarding their sensitivity. This scale was modified from the original forced choice (*True* / *False*) response format to a more conventional 7-point Likert scale (midpoint = *Neutral*), which is consistent with previous research (e.g., Evans & Rothbart, 2008; Smolewska, McCabe, & Woody, 2006). This study will utilize the unidimensional structure of the HSPS while removing nine items previously recommended. [2]

Confirmatory factor analysis (CFA) was conducted utilizing Amos 19.0 to assess the fit of the HSPS to male data. Commonly used fit indices and comparison thresholds were used to evaluate all CFA fit statistics, including the comparative fit index (CFI) above .90, the standardized root mean square residual (SRMR) below .10, and the root mean square error of approximation (RMSEA) below .08. The standardized residual covariance matrix was inspected for values greater than two in absolute value. Specifics related to these statistics are found in an assortment of different sources (e.g., Byrne, 2010; Hoyle, 2000; Hu & Bentler, 1999; Kline, 2005; Raykov & Marcoulides, 2006).

[2] Items of the HSPS originally recommended to be removed can be found in Smolewska et al. (2006).

Males completed the modified HSPS and scores were used for analysis and group assignment purposes. Initial fit statistics for the 18-item unidimensional factor structure, $\chi 2$ (135) = 266.98, $p < .001$, SRMR = .10, CFI = .66, RMSEA = .11 (90% CI: .09 .13), indicated model with low CFI, high RMSEA and SRMR values, and further evaluation identified high standardized residual covariances. CFA has been recognized as a technique useful for removing scale items, specifically those with low loadings, in order to reproduce a measure that demonstrates a better fit to data (Levine, 2005). With these data, after removing 6 items (Are you annoyed when people try to get you to do too many things at once; When you were a child, did your parents or teachers seem to see you as sensitive or shy; Are you deeply moved by the arts or music; and, Are you conscientious.) due to low loadings or high standardized residual covariances, fit statistics indicated an improved model fit, $\chi 2$ (54) = 76.68, $p = .02$, SRMR = .07, CFI = .91, RMSEA = .07 (90% CI: .03 .11). Scale reliability proved to be adequate, $\alpha = .84$, thus the remaining 12 items were averaged for a total sensitivity score (see Table 4.2).

For the purpose of group assignment, total scores were dichotomized to form two groups: HSP and non-HSP. According to distributions noted by Aron (1996), overall average HSPS scores ($M = 3.22$; $SD = .89$; average interitem $r = .30$) were split at about $20^{th}$ percentile to form groups of highly sensitive persons ($M \geq 4.00$) and non-sensitive persons ($M < 4.00$). A total of 19 male participants self-identified as highly sensitive while the remaining 65 were classified as non-sensitive (see Table 4.1).

Table 4.2: Items and statistics for the HSPS

| ITEM | λ | *M* | *SD* |
|---|---|---|---|
| Do other people's moods affect you? | .42 | 4.38 | 1.60 |
| Do you tend to be more sensitive to pain? | .55 | 2.69 | 1.44 |
| Do you startle easily? | .49 | 2.62 | 1.22 |
| Do changes in your life shake you up? | .70 | 3.29 | 1.53 |
| Do you find it unpleasant to have a lot going on at once? | .59 | 3.69 | 1.64 |
| When you must compete or be observed while performing a task, do you become so nervous or shaky that you do much worse than you would otherwise? | .55 | 3.06 | 1.53 |
| Do you seem to be aware of subtleties in your environment? | .12 | 4.81 | 1.55 |
| Do you find yourself needing to withdraw during busy days, into bed or into a darkened room or any place where you can have some privacy and relief from stimulation? | .50 | 2.83 | 1.56 |
| Are you easily overwhelmed by things like bright lights, strong smells, coarse fabrics, or sirens close by? | .73 | 2.38 | 1.55 |
| Are you made uncomfortable by loud noises? | .68 | 2.82 | 1.49 |
| Do you become unpleasantly aroused when a lot is going on around you? | .59 | 3.01 | 1.41 |
| Are you bothered by intense stimuli, like loud noises or chaotic scenes? | .63 | 3.07 | 1.53 |

**Conformity to Masculine Norms Inventory.** Conformity to masculine norms is defined as one's attempt to meet societal expectations for what constitutes masculinity in public or private life. Individual factors (i.e., SPS) are believed to have an effect on the extent to which a person conforms or does not conform to specific gender role norms. Conformity was measured using the short form of the Conformity to Male Norms Inventory (CMNI) (Mahalik et al., 2003), a self-report instrument developed for use by researchers to examine masculinity issues by assessing conformity to an array of masculine norms. The short-form includes 22 items scaled on a 4-point Likert scale (no *Neutal*) and represents the best two items from each of 11 subscales measuring separate dimensions of the masculinity construct. These higher-order factors are Winning, Emotional Control, Risk-Taking, Violence, Dominance, Playboy, Self-Reliance, Primacy of Work, Power Over Women, Disdain for Homosexuality, and Pursuit of Status. The 11 factors of the CMNI were initially represented by 94-items, however a response burden to

participants necessitated the development of short forms of the CMNI that lost the multidimensionality of the measure (Burns & Mahalik, 2008; Rochlen, McKelley, Suizzo, & Scaringi, 2008). The loss of multidimensionality is acceptable in this initial investigation because the concern is with global perceptions of conformity to masculinity.

The 22-item version of the CMNI that has been previously used to compute total scores for a single construct of masculine norm conformity will be utilized for this study. Although the CMNI-22 correlates at .92 with the CMNI Total for the 94-item scale (Mahalik et al., 2003), it has been reported that low internal consistency estimates plague the scale (Parent & Moradi, 2011). Furthermore, researchers using confirmatory analysis techniques have had difficulty demonstrating adequate model fits of the CMNI-22 (Owen, 2011). Despite these recent psychometric critiques of the CMNI, the instrument presents a theoretically-driven model of masculinity that is preferred over other indices of gender role orientation (Mahalik et al., 2003).

In sum, this brief, parsimonious measure allowed for ease of use by lessening the response burden on research participants. Fit statistics, $\chi 2$ (209) = 508.87, $p < .001$, SRMR = .13, CFI = .28, RMSEA = .13 (90% CI: .12 .15), indicated model with poor fit statistics. Further evaluation of residual covariances identified several misfitting items with values above two in absolute value. With the present data, after removing 12 items,[3] fit statistics indicated an improved model fit, $\chi 2$ (44) = 54.16 $p = .14$, SRMR = .08, CFI = .90, RMSEA = .05 (90% CI: .00 .10). Scale reliability of the remaining 10 items hovered near adequate bounds, $\alpha = .70$. The items and item statistics are listed below in Table 4.3 ($M = 2.46$; $SD = .35$; average interitem $r = .18$).

[3] Items removed can be found in Appendix G.

Table 4.3: Items and statistics for the Conformity to Masculine Norms Inventory-22

| ITEM | λ | *M* | *SD* |
|---|---|---|---|
| My work is the most important part of my life. | .33 | 2.18 | .81 |
| I make sure people do as I say. | .52 | 2.37 | .71 |
| I love it when men are in charge of women. | .40 | 2.31 | .78 |
| I tend to share my feelings.* | .47 | 2.27 | .80 |
| I should be in charge. | .61 | 2.79 | .70 |
| If I could, I would frequently change sexual partners. | .42 | 1.80 | .86 |
| I never ask for help. | .53 | 2.29 | .77 |
| Men and women should respect each other as equals.* | .44 | 1.57 | .63 |
| Winning isn't everything, it's the only thing. | .55 | 2.50 | .87 |
| It bothers me when I have to ask for help. | .38 | 2.54 | .80 |

Notes: * Indicates reverse coded item

**Gender Role Conflict Scale.** GRC is a psychological state in which socialized gender roles have negative consequences for the person or others, and it can result from deviation from or violation of gender role norms, trying to meet or failing to meet gender role norms, experiencing discrepancies between actual and culturally ideal self-concepts, and experiencing personal stress for conforming to masculine ideology (O'Neil, 2008). GRC has been measured with the Gender Role Conflict Scale (GRCS; O'Neil et al., 1986) for more than 20 years during which the scale has demonstrated evidence of validity and adequate psychometric properties (O'Neil, 2008). The GRCS is a 37-item, self-report instrument used to assess aspects of gender-role conflict described above. Respondents are asked to report the degree to which they agree or disagree with statements about their personal gender-role attitudes, behaviors, and conflicts using a 6-point Likert scale (no *Neutral*). A high score reflects an expression of gender-role conflict and fear about femininity.

The GRCS is comprised of four factors, including Success, Power, and Competition (SPC) which represents feelings of stress related to needing to be successful; Restrictive Emotionality (RE) clearly indicates being emotionally inexpressive; Restrictive Affectionate

Behavior Between Men (RABBM) reflects discomfort in exchanging affection with other men; and Conflicts Between Work and Family Relations (CBWFR) refers to feeling conflicted in one's role (O'Neil et al., 1986). For these factors, internal consistency estimates have ranged from .78 to .92, and test-retest reliabilities over a month long period have ranged from .72 to .86. Evidence of construct validity can be found in O'Neil et al. (1986) and Good et al. (1995).

Fit statistics, $\chi 2$ (625) = 1077.99, $p < .001$, SRMR = .13, CFI = .69, RMSEA = .09 (90% CI: .08 .10), indicated a poor fitting model. Further evaluation of the items revealed that several items were poor-fitting. With the present data, after removing sixteen items,[4] fit statistics indicated improved fit statistics, $\chi 2$ (185) = 259.61, $p < .001$, SRMR = .08, CFI = .90, RMSEA = .07 (90% CI: .05 .09). Items and statistics for the GRCS subscales are presented in Table 4.4. In total 21 items were utilized, and all subscales demonstrated adequate internal consistency estimates ($\alpha > .70$).

Table 4.4: Items and statistics for the Gender Role Conflict Scale

| SCALE ITEM | Avg. *r* | *α* | *M* | *SD* |
|---|---|---|---|---|
| **Success, Power, & Competition** | .35 | .70 | 4.18 | .91 |
| Making money is part of my idea of being a successful man. | | | 4.81 | 1.07 |
| I often feel that I need to be in charge of those around me. | | | 3.65 | 1.19 |
| Being smarter or physically stronger than other men is important to me. | | | 4.40 | 1.32 |
| I like to feel superior to other people. | | | 3.89 | 1.42 |
| **Conflicts Between Work and Family Relations** | .60 | .82 | 3.97 | 1.16 |
| My career, job, or school affects the quality of my leisure or family life. | | | 4.25 | 1.30 |
| My work or school often disrupts other parts of my life (home, health, leisure). | | | 3.93 | 1.33 |
| Overwork, and stress, caused by a need to achieve on the job or in school, affects/hurts my life | | | 3.74 | 1.44 |

[4] Items removed are included in Appendix G.

*(table 4.4 continued)*

| | | | | |
|---|---|---|---|---|
| **Restrictive Emotionality** | 45 | .86 | 2.95 | .96 |
| I have difficulty telling others I care about them. | | | 2.88 | 1.39 |
| Strong emotions are difficult for me to understand. | | | 2.60 | 1.28 |
| Talking (about my feelings) during sexual relations is difficult for me. | | | 2.88 | 1.31 |
| I have difficulty expressing my emotional needs to my partner. | | | 2.76 | 1.28 |
| I have difficulty expressing my tender feelings. | | | 3.08 | 1.26 |
| I often have trouble finding words that describe how I am feeling. | | | 3.36 | 1.47 |
| I do not like to show my emotions to other people. | | | 3.33 | 1.29 |
| Telling my partner my feelings about him/her during sex is difficult for me. | | | 2.68 | 1.45 |
| **Restrictive Affectionate Behavior** | .53 | .87 | 3.13 | 1.08 |
| Affection with other men makes me tense. | | | 3.19 | 1.33 |
| Men who touch other men make me uncomfortable. | | | 3.69 | 1.65 |
| Hugging other men is difficult for me. | | | 2.62 | 1.32 |
| I am sometimes hesitant to show my affection to men because of how others might perceive me. | | | 3.04 | 1.32 |
| Being very personal with other men makes me feel uncomfortable. | | | 3.01 | 1.29 |
| Men who are overly friendly to me, make me wonder about their sexual preference (men or women). | | | 3.23 | 1.39 |

**Relationship Assessment Scale.** The instrument used to measure female partner relationship satisfaction was the Relationship Assessment Scale (RAS; Hendrick,1988). This brief 7-item measure allowed for ease of use by lessening the response burden on research participants. Items are assessed on a 7-oint semantic differential response scale anchored at the extremes (*1 = Not Very Much at All* ; *7 = Very Much*). The items are specific enough to tap several relationship dimensions (e.g., love, problems, and expectations) yet general enough to be appropriate for married couples, couples who are living together, and gay couples. Evidence of scale internal consistency and discriminatory ability were provided in the original conceptualization (Hendrick, 1998), and recently the psychometric characteristics of the scale were evaluated and determined to be of high quality when assessed in a large community sample of more than 1500 participants (Cassepp-Borges & Pasquali, 2011).

Fit statistics, $\chi 2$ (14) = 41.25, $p < .001$, SRMR = .10, CFI = .90, RMSEA = .15 (90% CI: .10 .21), indicated a model with high RMSEA estimates. Further evaluation of the items revealed that participants may have easily misinterpreted one of them; therefore this item was removed from the analysis. With the present data, after removing two items[5], fit statistics indicated a strong model fit, $\chi 2$ (5) = .64, $p$ = .99, SRMR = .01, CFI = 1.0, RMSEA = .00 (90% CI: .00 .00). Scale reliability was adequate, $\alpha$ = .86 ($M$ = 5.31; $SD$ = .71; average interitem $r$ = .53). The relational satisfaction items and item statistics are listed in Table 4.5.

Table 4.5: Items and statistics for the Relationship Assessment Scale

| ITEM | $\lambda$ | *M* | *SD* |
|---|---|---|---|
| How well does this person meet your relational needs? | .80 | 6.15 | .94 |
| In general, how satisfied are you with your relationship? | .91 | 6.24 | 1.01 |
| To what extent has your relationship met your original expectations? | .72 | 6.06 | 1.23 |
| How good is you relationship compared to most? | .86 | 6.23 | 1.01 |
| How much do you love your partner? | .58 | 6.74 | .61 |

**Managing Affect and Differences Scale**. The Measuring Affect and Differences Scale (MADS) (Arrelano & Markman, 1995) is a comprehensive self-report index to assess relational partners' communication abilities. The MADS was designed to evaluate specific behaviors in relationships, and the subscales of the MADS primarily reflect a host of behaviors related to relational maintenance and conflict management. Various subscales include items regarding honestly expressing one's feelings about the other, validating the feelings of one's partner, and a tendency to offer feedback.

Items on the MADS assess very concrete communication and conflict management skills that measure specific constructive and destructive behaviors (Arrelano & Markman, 1995, p. 322). For the scale, 55 items are divided into 12 different subscales measured on 5-point Likert

[5] The items removed were, How many problems are there in your relationship and How often do you wish you hadn't gotten into this relationship.

scales (the subscales used in this study and their definitions are listed in Table 4.6). Across two independent studies, MADS demonstrated adequate internal consistency reliability and was able to discriminate successfully dissatisfied from satisfied couples solely on the basis of those couples' reported use of specific communication and conflict resolution skills (Arrelano & Markman, 1995). In particular, dissatisfied couples reported more use of destructive strategies during conflict, and satisfied couples reported using higher levels of constructive conflict management skills such as listeing, editing, and feedback. Other studies have also found that the scale possesses good internal consistency (e.g., Creasey & Hesson-McInnis, 2001; Creasey, Kershaw, & Boston, 1999).

The model fit for the female partner responses was assessed. For all 55 items, fit statistics indicated a poor fitting model, $\chi 2$ (1419) = 2993.39, $p < .01$, SRMR = .13, CFI = .55, RMSEA = .12 (90% CI: .11 .13). After removing thirty-six items[6] due to high standardized residual covariance values or because of low loadings, the model showed improved fit, $\chi 2$ (147) = 216.36, $p < .01$, SRMR = .08, CFI = .90, RMSEA = .08 (90% CI: .06 .10). During item removal, seven subscales were removed because they presented low factor loadings ($\lambda < .30$), which included the Love and Affection, Emotional Expressivity, Stop Actions, Withdrawal, Negative Escalation, Focusing, and Communication over Time subscales. The subscales that were retained and their definitions are included in Table 4.6. Internal consistency estimates were adequate for the remaining five subscales, ($\alpha > .70$), thus the items retained for each dimension were averaged for total subscale scores (see Table 4.7).

[6] Items removed included in Appendix G.

Table 4.6: Subscales of the Managing Affect and Differences Scale

| | |
|---|---|
| Expressing | Expressing is telling one's partner what one is feeling by discussing one's thoughts or feelings clearly, constructively, and simply. |
| Listening | Listening is taking value in partner's perspective or point of view and is evident through skills such as attentive listening and paraphrasing. |
| Editing | Editing is controlling one's reactions to a partner's message. Some edit behaviors are as follows: listening to a partner's entire message before responding; saying things in a positive manner rather than complaining. |
| Negativity | Negativity is an expression of negative attitudes or feelings. |
| Feedback | Feedback is paraphrasing or asking for clarifications of partner's message to make certain that it is interpreted accurately. |

Table 4.7: Items and statistics for the Managing Affect and Differences Scale

| ITEM | Avg. *r* | *α* | λ | *M* | *SD* |
|---|---|---|---|---|---|
| **Expressing** | .54 | .82 | .39 | 3.99 | .81 |
| When my partner feels hurt, they tell me | | | .81 | 4.02 | .85 |
| My partner tells me when he's disappointed | | | .79 | 3.96 | .83 |
| My partner tells me when I have done something that bothers him | | | .73 | 4.06 | .77 |
| My partner says exactly what he thinks or feels. | | | .61 | 3.83 | 1.13 |
| **Listening** | .61 | .86 | .85 | 3.89 | .84 |
| My partner listens attentively to what I say | | | .84 | 4.05 | .84 |
| My partner tries to understand how I feels by listening to what I have to say | | | .87 | 4.18 | .85 |
| My partner listens to my whole message before responding | | | .73 | 3.57 | .90 |
| My partner gives me attention. | | | .70 | 4.40 | .78 |
| **Editing** | .44 | .83 | .96 | 3.95 | .72 |
| My partner tries to express appreciation rather than complaints | | | .61 | 3.99 | .80 |
| My partner tries to interact positively with me | | | .74 | 4.32 | .73 |
| My partner tries to focus on the positive side of situations | | | .75 | 4.01 | .94 |
| My partner expresses appreciation for my help even when he doesn't succeed | | | .65 | 4.18 | .68 |
| My partner tries to think about my point of view when I find myself thinking only of my point of view | | | .82 | 3.81 | .89 |
| **Negativity** | .45 | .70 | -.76 | 1.86 | .71 |
| My partner often interprets my messages more negatively than they are intended | | | .61 | 3.01 | 1.11 |
| My partner often hassles and nags my partner | | | .64 | 2.45 | 1.09 |
| I often gets on my partner's nerves | | | .72 | 2.40 | 1.11 |
| **Feedback** | .16 | .77 | .89 | 3.64 | .74 |
| My partner tries to check with me whether his interpretations are accurate. | | | .90 | 3.82 | .82 |
| My partner summarizes my messages to make sure that my point of view is understood | | | .70 | 3.88 | .88 |
| When discussing a problem, my partner tries to focus on that one problem. | | | .61 | 3.83 | .80 |

## Results

In order to test the hypotheses presented at the outset of this study, bivariate correlations and independent samples t-tests are performed. Furthermore, a structural equation model representing the proposed effects of sensitivity on masculinity and gender role stress is evaluated to consider possible causal relations explained by OSA theory. Another model testing effects of SPS on MADS and relationship satisfaction is also tested.

### Hypothesis Testing

**Hypotheses 1 and 2.** Bivariate correlations reported in Table 4.8 indicate that, for all men, higher levels of SPS were not associated with greater conformity to male norms. Results indicate partial support for the assumption that SPS is correlated with greater gender role stress, as it is significantly related to total GRCS as well as subscale factors of conflict between family and work, restrictive emotionality, and restrictive affectionate behavior between men.

H1 predicted that HSM report greater conformity to masculine norms than non-sensitive men, and H2 stated that HSM report greater gender role stress than non-sensitive men. Independent samples t-tests were utilized to compare scores on the CMNI (H1) and the subscales of the GRCS (H2) in order to test the hypotheses. Results failed to identify significant differences between HSM and non-HSM with respect to CMNI scores, however two significant group differences were identified such that HSM scored higher than non-HSM regarding total gender role conflict stress, $t$ (82) = -2.29, $p < .05$, $r^2 = .25$, and conflict between work and family, $t$ (82) = -2.43, $p < .05$, $r^2 = .26$. Findings indicate HSM ($M = 3.87$; $SD = .56$) experience greater levels of gender role stress than non-HSM ($M = 3.47$; $SD = .72$), which is partially represented as HSM ($M = 4.53$; $SD = .95$) reporting higher stress surrounding work/life conflicts than non-HSM ($M = 3.81$; $SD = 1.17$).

Table 4.8: Bivariate correlations between male-reported sensitivity and masculinity variables

| | SPS | CMNI | SPC | Conflict | RE | RAB | GRCT |
|---|---|---|---|---|---|---|---|
| SPS | -- | .10 | -.05 | .40*** | .28* | .19 | .32** |
| CMNI | .08 | -- | .65*** | -.11 | .57*** | .56*** | .64*** |
| SPC | -.04 | .45*** | -- | .32** | .34** | .36*** | .80*** |
| Conflict | .33*** | .08 | .24* | -- | .21* | .23* | .74*** |
| RE | .24* | .44*** | .26* | .18 | -- | .72*** | .87*** |
| RAB | .16 | .43*** | .28** | .19 | .62*** | -- | .88*** |
| GRCT | .27* | .49*** | .62*** | .62*** | .74*** | .76*** | -- |

NOTES: All correlations corrected for attenuation; *** = $p < .001$; ** = $p < .01$; * = $p < .05$; SPS = Sensory-processing sensitivity; CMNI = Conformity to Male Norms Inventory; SPC = Success, Power, & Competition; ; Conflict = Conflicts Between Work and Family Relations; RE = Restrictive Emotionality; RAB = Restrictive Affectionate Behavior; GRCT = Gender Role Stress Total; Satis = Male Relational Satisfaction

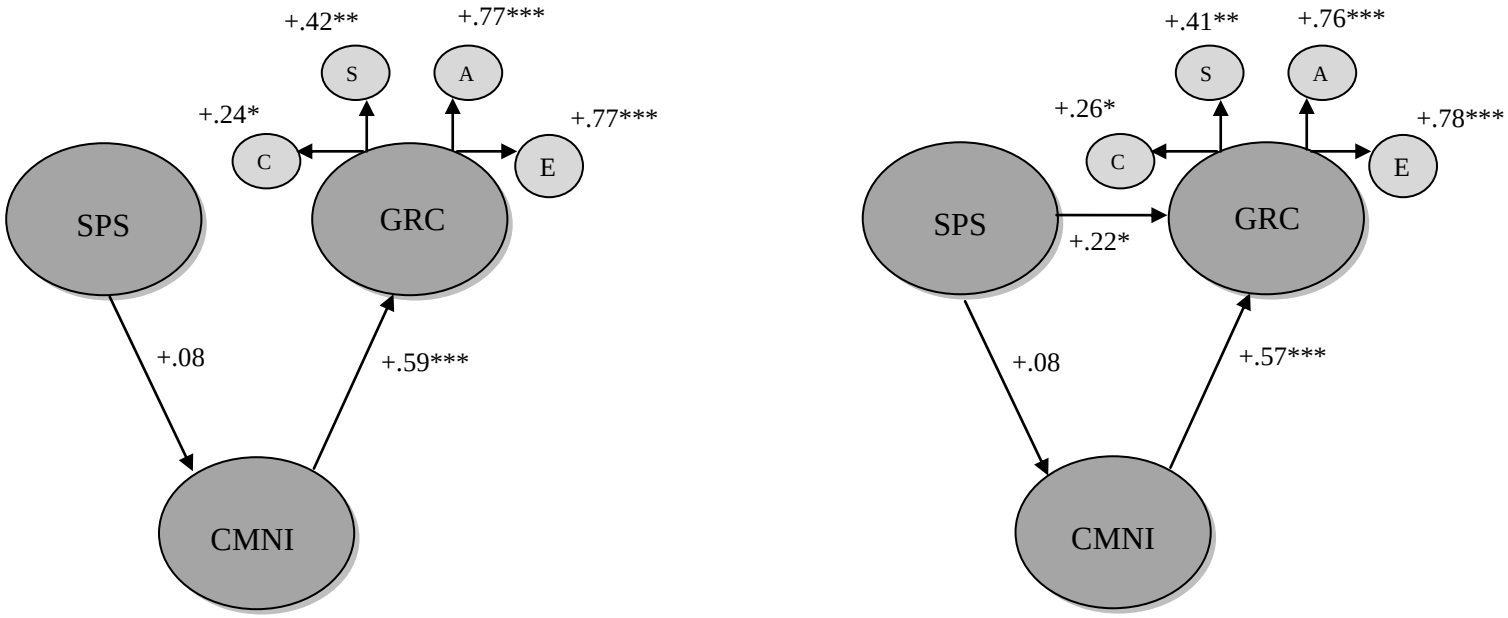
**Structural Equation Model.** To identify the best representation of the relations among SPS, conformity to masculine norms, and gender role conflict, two structural models utilizing item parcels for each subscale were evaluated using SEM procedures and following the maximum likelihood estimation method in Amos 19.0. Item parcels were chosen because a goal of the study is to model effects of a latent variable at a given level of generality. Thus, parceling of items can minimize or cancel out the effects of nuisance factors at a lower level of generality (see Little, Cunningham, Shahar, &Widaman, 2002).

Greater conformity to masculine norms is predicted to lead to greater gender role stress for HSM. This is proposed in light of the assumptions of Pleck's Gender Strain Paradigm (1995), which asserts that when men overly conform to societal expectations for masculine behavior they will necessarily experience strain. In the models tested for this study, the components of conformity and strain are operationalized by constructs CMNI and GRCS, respectively. Two models were estimated, one in which SPS and GRCS were uncorrelated and thus CMNI fully mediated the relationship with stress, and one in which SPS and CMNI were correlated (partially mediated model). Fit statistics are presented in Figure 4.3, and, while

neither model was well-fitting, they showed that the partially mediated model resulted in a very slight statistical improvement to model fit. However, the CFI estimate was lower than the recommended value of .90, and the RMSEA value was noticeably higher than the conventional cut-off value of .08, likely a product of small degrees of freedom in the model (Kenny, Kaniskan, & McCoach, 2011). Figure 4.3 also presents the standardized path coefficients for the relations among SPS, CMNI, and GRCS. Most paths were significant and suggest positive associations among variables, excluding the direct path between SPS and CMNI. This suggests that SPS has slight direct influence on gender role stress, and no significant direct association with CMNI.

**Hypotheses 3 to 7.** Bivariate correlation results for men's self-reported sensitivity and female reports of men's affect management behaviors are presented in Table 4.9. Higher SPS was predicted to be positively associated with constructive affect management behaviors (expressing, listening) and with relationship satisfaction. No correlations were found to be statistically significant. Correlations indicate that higher SPS, as self-reported by males, was not associated with any female-reports of male partner behavior or female-reported satisfaction.

H3-H7 predict a number of constructive and destructive affect management behaviors that HSM are more likely to engage in, for instance less editing of messages (H3), greater expression of negative emotions (H4), better listening (H5), and providing more feedback (H6). Moreover, it was predicted that partners of HSM would be more satisfied than partners of non-HSM. Independent samples t-tests were performed to test these hypotheses, and only one statistically significant difference was identified. Results indicate that HSM were perceived to be more expressive of their negative emotions, $t$ (76) = -1.66, $p$ = .05, $r^2$ = .19. Partners are more likely to report HSM express feelings of being bothered or disappointed ($M$ = 4.25; $SD$ = .56) more than non-HSM ($M$ = 3.91; $SD$ = .82).




Fully Mediated Model Fit Statistics:
$\chi 2$ (9) = 27.00, $p < .01$
SRMR = .11
CFI = .80
RMSEA = .16 (90% CI: .09 .22)

Partially Mediated Fit Statistics:
$\chi 2$ (8) = 23.04, $p < .01$
SRMR = .09
CFI = .83
RMSEA = .15 (90% CI: .08 .22)

Figure 4.3: Coefficients and fit statistics for the SPS, CMNI, and Gender Role Stress models

Notes: *** = p < .001; ** = p < .01; * = p < .05; SPS = Sensory-processing sensitivity; CMNI = Conformity to Male Norms; GRC = Gender Role Conflict Scale; C = Conflict Between Work and Family; S = Success, Power, and Competition; A = Restricted Affectionate Behavior between Men; E = Restrictive Emotionality.

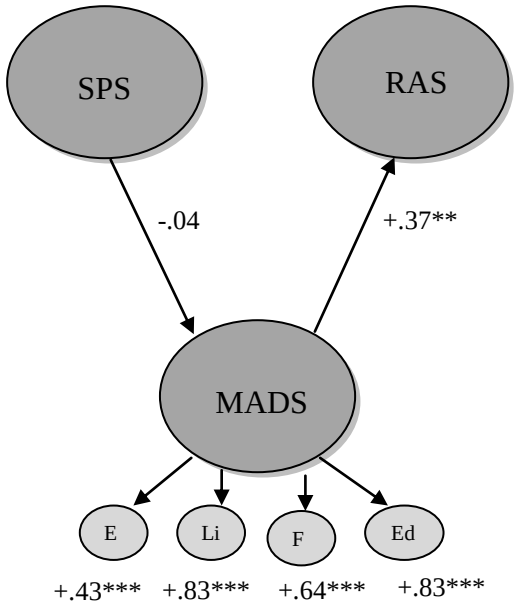
Table 4.9: Bivariate correlations between male-reported sensitivity and female reports of affect

| | SPS | Express | Listen | Editing | Negativity | Feedback | RAS |
|---|---|---|---|---|---|---|---|
| SPS | -- | .14 | -.01 | -.02 | .07 | -.15 | -.13 |
| Expr. | .12 | -- | .42*** | .32** | -.13 | .70*** | .04 |
| Listen | -.01 | .35** | -- | .61*** | -.68*** | -.64*** | .29* |
| Editing | -.02 | .27* | .70*** | -- | -.74*** | .61*** | .47*** |
| Negativity | .05 | -.09 | -.53*** | -.58*** | -- | -.30** | -.29** |
| Feedback | -.12 | .56*** | .52*** | .50*** | -.22* | -- | .19 |
| RAS | -.11 | .03 | .25* | .41*** | -.22* | .15 | -- |

NOTES: All correlations corrected for attenuation; *** = $p < .001$; ** = $p < .01$; * = $p < .05$; SPS = Sensory-processing sensitivity; Expr. = Expressing; Listen= Listening; RAS = Satisfaction.

**Structural Equation Model.** To identify the best representation of the relations among SPS, affect management behaviors, and relationship satisfaction, a structural models utilizing item parcels for each subscale were evaluated using SEM procedures and following the maximum likelihood estimation method in Amos 19.0.

The model predicts that higher sensitivity leads to more positive affect management behaviors such as listening and emotional expression which lead to higher relational satisfaction for partners of HSM. This is predicted in light of the construct of emotional intelligence, which explains that people of higher emotional intelligence are better able to manage their moods which contributes to higher relational quality (Ciarrochi et al., 2000), as well as the belief that better listening contributes to positive relational outcomes (Bodie, 2012). Thus, since HSM are considered to be more expressive (Aron, 2000), and are better listeners (Gearhart, 2011), these qualities should contribute to higher relationship satisfaction for their partners. This assumption was estimated whereby relationship behaviors and satisfaction were operationalized by MADS and RAS, respectively. The MADS subscales mediate the relationship between sensitivity and satisfaction. Fit statistics and path coefficients for the model are presented in Figure 4.4.




Model Fit Statistics:
$\chi 2$ (9) = 31.09, $p$ < .01
SRMR = .10
CFI = .83
RMSEA = .17 (90% CI: .11 .24)

Figure 4.4: Coefficients and fit statistics for SPS, MADS, and relationship satisfaction model

Figure 4.4 Notes: ***p < .001; **p < .01; *p < .05; SPS = Sensory-processing sensitivity; MADS = Managing Affect and Differences Scale; E = Expressing; Li = Listening; F = Feedback; Ed = Editing; RAS = Satisfaction

The model was not well-fitting, and it showed that SPS was not a significant predictor of MADS behaviors. However, MADS behaviors were positively related to relational satisfaction (as suggested by emotional intelligence research). For the model, the CFI was lower than the recommended value of .90, and the RMSEA value was noticeably higher than the conventional cut-off value of .08 (again, likely a product of low degrees of freedom; Kenny et al., 2011), suggesting that SPS has no direct influence on partner's perceptions of male affect management behaviors. However, the performance of behaviors such as listening and emotional expression may lead to higher relationship satisfaction.

## Discussion

This study investigated a number of claims made by Aron (2000) regarding the nature of HSM in American society and relationships. The influence of SPS is presumed to cause males to be more expressive of their feelings and sensitive to the needs of others, qualities that are beneficial for their close relationships but cause others to perceive and label them as "feminine". Thus, it was predicted that HSM would experience greater conformity to masculine norms, greater gender role stress, and would engage in more "feminine" behaviors such as listening and expressing their feelings. Although tests were largely unimpressive, three primary findings are of note.

With respect to the "feminine" nature of HSM (Aron, 2000), OSA theory predicts that when HSM find themselves unable to meet societal expectations for behavior, that they will "actively change actions, attitudes, or traits to be more congruent with the representations of the standard" (Silvia & Duval, 2001, p. 231). Results of bivariate correlations and independent samples t-tests failed to find support for the claims of Aron (1996, 2000) that HSM would report greater conformity to masculine norms, but did support claims of greater HSM gender role stress compared to non-HSM. HSM may conform less to American norms for masculine behavior and as a result they experience greater gender role stress because they are criticized for not being masculine enough (O'Neil, 2008) as shown by correlations in Table 4.8.

This speculation is also represented by models of the process of gender role stress which failed to indicate a direct influence of SPS on conformity to masculine norms (see Figure 4.3). Essentially, these models tested propositions set forth by Pleck's (1995) gender role strain paradigm which suggests that actual or imagined violation of gender roles leads people to overconform to them, and that violating gender roles has consequences for males such as high

gender role stress (Pleck, 1995). Ultimately, however, the models failed to yield recommended fit statistics and only partially supported the assumption that HSM experience greater gender role stress (Aron, 2000).

Finally, claims that positive relational behaviors associated with HSM, such as increased understanding and higher sharing were not support. Generally speaking, it appears female perceptions of HSM behavior do not differ significantly from female perceptions of non-HSM behavior, other than differences in mean scores which indicated partners of HSM perceived their men to be more expressive of negative emotions. Furthermore, a causal model attempting to depict the relations among SPS, relational behaviors, and relationship satisfaction was not only poor fitting, it also failed to demonstrate a significant path association between SPS and behaviors measured by the MADS. In these data, there appear to be no differences in the perceptions of HSM and non-HSM partners with respect to their level of relationship satisfaction, and in fact results tended to indicate that partners of HSM were less satisfied (although not statistically significant).

**Limitations**

Although care was taken to address a number of initial concerns, a few limitations surround this study. Specifically, issues regarding the instruments used, their structure, the concept of masculinity, and the sample size of the study will be discussed.

The most glaring limitation of this study is that the small sample size of the study drastically reduces the power to find effects, especially those that may be very small. Given the current sample size of 84, divided into 65 non-HSM couples and 19 HSM couples, G*Power 3.1 (Lang et al., 2009) post-hoc sensitivity tests calculated the power to detect large effects (.50) at .60, indicating that these data, then, are vastly underpowered to detect any small or even

moderate effects. Although the response rate for female partners was very high (92%+), the restriction of only allowing male participants enrolled in Communication Studies classes at Louisiana State University who had been in a romantic relationship for three or months created a small population from which to draw an adequate sample of both HSM and non-HSM couples. Ultimately, then, non-significant findings may be simply undetectable given the current sample size; therefore any conclusions that no differences in affect management behaviors exist must be tempered.

Furthermore, scale structures for measures such as the HSPS and MADS failed to demonstrate appropriate fit statistics that allowed to adequately capture the full breadth of the trait. For the MADS, given the number of items in the scale as well as the large number of different subscales, a well fitting model was expected to be difficult. Even after removal of four subscales and more than twenty items the measure continued to show fit problems, ultimately resulting in the loss of seven subscales. Many of the subscales that were removed were those reflecting destructive affect management behaviors. In particular, the withdrawal scale demonstrated high standardized residual covariance values when included in the model. And, for the HSPS, again, poor fit statistics necessitated the removal of items that reflect positive qualities of the trait. Items regarding conscientiousness, discriminatory ability, and deeper processing were effectively removed from the operationalization of the trait, thus limiting the conclusions to those that are associated with the sensory discomfort quality of SPS.

A general bias towards masculinity is also present in this dissertation. Here, masculinity has been largely discussed in terms of a unidimensional ideology that is static. Yet, notions of masculinity are complex, as scholars have asserted that there are multiple dimensions of masculinity (see Mahalik et al., 2003) and multiple domains, or masculinities (e.g., Kimmel,

Hearn, & Connell, 2005). This paper centers upon "hegemonic masculinities", or the image of masculinity of those men who hold power, which has become the standard in psychological evaluations, sociological research, and self-help and advice literature for teaching young men to become real men (Kimmel, 2004, p. 184). In this way, this research, as well as that of Aron (2000) contributes to a biased view of masculinity while ignoring others and reaffirms ideologies of the dominant group. Future research should consider these multiple masculinities and utilize measures of gender that offer less homophobic views of masculinity.

Finally, given the self-report methods used in this study it seems possible that people may report what is desired rather than what is, a common problem linked to any self-report research study of behavior or attitude (see Furnham, 1986). In particular, with their understanding of the study purposes, it may be that highly sensitive males were more perceptive to the implicit intentions or functions of questions; therefore maybe HSM were more hesitant to mark their actual feelings or behaviors. Also, it could be that females were reluctant to honestly report perceptions of their partners' behavior for fear their answers may be revealed, despite assurances of confidentiality. Given that no observations of behavior were examined in this study, and that all data were collected via self-report, future research should consider how SPS may differentially influence men in actual interactions.

## Conclusion

The purpose of study two was to identify differences between HSM and non-HSM with respect to conformity to masculine norms, gender role stress, and affect management behaviors in relationships. Results indicated partial support for claims of Aron (2000) as well as the gender strain paradigm (Pleck, 1995) in that HSM were more likely to report experiencing greater gender role stress, which is thought to be the case because HSM are more neurotic and self-

aware of not meeting societal expectations for masculinity. Additionally, only differences in expression of emotion (usually negative) were identified between partner perceptions of HSM and non-HSM. Unfortunately, the current study is underpowered to detect any small effects of SPS, but suggest partners of HSM may be less satisfied.

# CHAPTER FIVE

# DISCUSSION

This chapter presents comprehensive findings from Chapters Three and Four in light of the questions posed in Chapter Two. Next, a discussion of the study limitations occurs, including the difficulties surrounding the self-report measurement of a broad biological trait like SPS and the smaller than recommended sample sizes of the reported studies. Then, directions for future research regarding the influence of sensory-processing sensitivity on interpersonal and intrapersonal communication are suggested. Finally, a short conclusion will close the dissertation. The chapter begins by reviewing the sets of research questions of this research project and providing answers to each.

## Discussion of Results

Two sets of research questions were posed at the outset of this manuscript (see Table 2.2, p. 34), those which focused on overstimulation (Aron & Aron, 1997) and inferential accuracy (Aron, Aron, & Jagiellowicz, in press), and those reflecting claims that highly sensitive men are more "feminine" and engage in different relationship behaviors than non-sensitive men (Aron, 2000). Research questions aim to provide support (or non-support) for undocumented claims by Aron (1996, 2000; Aron & Aron, 1997) about highly sensitive persons. Findings in this dissertation have provided partial, full, or contradictory support for those suppositions.

The claim never finding any support is that HSPs are more aware of the subtle and nuanced emotional expressions of others (Jagiellowicz et al., 2011; Aron et al., in press). Experiment results presented in Chapter Three indicate that, in the control condition, HSPs were no more accurate than non-HSPs at recognizing the emotional expressions of posed actors. In

fact, means of error scores indicate that HSPs were actually worse, a finding that may reflect the greater general arousal for HSPs when introduced to novel environments or evaluative tasks (Aron, & Aron, 1997). Thus, to answer the question, Are HSPs more accurate at detecting emotions than non-HSPs, the answer is probably no.

HSPs were also less accurate at making judgments of emotional expressions when exposed to moderate and high stimulation. Indeed, a primary focus of this dissertation is to answer the questions of whether highly sensitive persons (HSPs) function differently because they are more easily overstimulated by sensory information, a central claim of Aron (1996; Aron & Aron, 1997). The first part of this two-part claim is that HSPs are considered to become more bothered by moderate stimuli and "very frazzled" by high intensity stimulation. In Chapter Three, an experiment was designed which exposed HSPs and non-HSPs to varying intensities of audio stimulation (or none) to test for differences in distraction. Results indicated that highly sensitive persons reported more distraction by audio stimulation as well as afforded greater attention to their environment, which provides support for the claim that higher levels of SPS lead to greater arousability. Specifically, results establish that highly sensitive persons are bothered by random, intermittent audio distractions as well as constant radio static. Therefore, the answer to the question, Are HSPs more bothered by stimulation, results indicate yes.

Extending upon the first claim, Aron (1996; Aron & Aron, 1997) suggested that higher levels of arousal lead to greater deficits in cognitive or social performance. Citing theories such as Gottman's (1990) Diffuse Physiological Arousal theory, it was suggested that, for HSPs, a tendency to become more easily overwhelmed by stimulation led to behavioral and cognitive inhibition. HSPs are presumed to suffer on tasks such as performance tests (Aron, 1996), and results from the experiment in Chapter Three revealed that as stimulation was introduced, HSPs

performed comparatively worse when exposed to audio stimulation than did non-HSPs. Specifically, HSPs recorded, on average, more errors in non-verbal decoding judgments on tests of non-verbal decoding accuracy than non-HSPs when exposed to stimulation. Differences were most pronounced in the moderate stimulation condition suggesting that mid-level stimuli may be more detrimental for HSPs than non-HSPs. Such stimuli may include music volume a bit too loud, being in crowds, and the smell of smoke, all of which, when consciously and consistently attended to can cause detriments in performance. Overall, differences in accuracy between HSPs and non-HSPs were most pronounced facial expression recognition test, indicating that HSPs average more incorrect responses. This is important because the facial text recorded the fewest errors, in part suggesting that the negative influence of stimulation was more drastic for HSPs.

The second set of questions surrounded the claims of Aron (2000) regarding highly sensitive men (HSM). This dissertation asked whether HSM were more understanding of their relational partners and more expressive of their own feelings. Results from self-report surveys in Chapter Four indicated that, according to average scores, partners of HSM reported their men were more expressive than non-HSM, however emotional expressions tended to be negative (e.g. My partner tells me when he's disappointed. The question of whether HSM are more expressive than non-HSM is partially answered in the affirmative, and results indicate that HSM are more likely to express feelings of disappointment or hurt which is likely because HSPs are more emotionally reactive.

Finally, two questions investigated controversial claims by Aron (2000, p. 54) that, by failing to meet societal explanations for gendered behavior, HSM must try harder to be seen as masculine which causes them to experience greater gender role stress. Self-report survey responses indicated that HSM did not report greater conformity to masculine norms, as

presupposed by Aron (2000). The answer to the question, Are HSM more feminine, is not fully answered here; but it appears that college-aged HSM do not try to conform to contemporary norms of masculinity more so than non-HSM, as predicted.

Aron (2000) continues by suggesting that the inherent femininity of HSM causes them to experience higher levels of gender role stress because they are not meeting societal expectations of masculinity (O'Neil, 2008). Results from the study in Chapter Four indicate that greater gender role stress is evident for HSPs. A model representing predictions of the gender strain paradigm theory (Pleck, 1995) proposed that HSPs would demonstrate higher conformity which would then lead to greater gender role stress was not well-fitting. Not only did the model tested in this manuscript failed to fulfill adequate fit criteria, the first path coefficient between SPS and CMNI failed to reach a meaningful level of association. Therefore, to answer the question, Do HSM experience greater gender role stress, the answer is yes, but not because they are more conforming to American masculine ideology. It may be speculated that greater self-awareness of not meeting standards for masculine behavior drives HSM's gender role stress. GRCS results from the "intrapersonal context" whereby "the private experience of negative emotions and thoughts when experiencing gender role devaluations, restrictions, and violations" is greater for HSM because they are more sensitive to their thoughts, cognitions, and self-evaluations.

In sum, evidence in this dissertation provides initial support for some of the claims made by Aron (1996, 2000; Aron & Aron, 1997) and the propositions presented in chatper 2 of this dissertation (see Table 5.1). HSPs are more distracted by stimulation and that this stimulation has a detrimental impact on performance, at least with respect to non-verbal decoding accuracy (especially facial expressions of emotion). Furthermore, HSM are more likely to experience feelings of gender role conflict and stress, possibly because they are more emotionally expressive

thus failing to meet societal expectations for restricted emotionality. These answers and results mainly reflect negative consequences of SPS, a finding that may be explainable by considering limitations of the self-report measure of sensitivity itself.

Table 5.1: Propositions tested and outcomes

| | | |
|---|---|---|
| Proposition 2 | If sensitivity to stimuli causes HSPs to experience greater sensory discomfort, then HSPs will be less able to process social information. | Supported |
| Proposition 3 | If HSPs are more self-aware, then they are expressive of their feelings. | Partial Support |
| Proposition 5 | If HSPs process non-verbal facial and vocal cues of social actors more intently, then they are more accurate at inferring true emotional states. | Not Supported |
| Proposition 6 | If deeper processing contributes to cognitive backlog, then exposure to multiple or intense stimuli will cause HSPs to perform more poorly during cognitive processing tasks. | Supported |
| Proposition 8 | If HSPs are more emotionally reactive, they experience greater levels of stress. | Partial Support |
| Proposition 10 | If highly sensitive partners are aware of others' feelings, then they should experience more understanding in their relationships | Not Supported |
| Proposition 12 | If HSPs more deeply process the messages of others, then relational partners should report more feelings of being listened to and understood. | Not Supported |
| Proposition 13 | If more empathy is conveyed by HSPs, then they should experience greater relational satisfaction. | Not Supported |

## Limitations

There are three general limitations that impede the generalizability of findings in this dissertation. The first limitation surrounds the ability of the self-report measure of sensitivity, the Highly Sensitive Persons Scale (Aron & Aron, 1997), to adequately capture the conceptual breadth of the trait, thus limiting the explanations for findings. The second limitation is the ability of the studies reported in this dissertation to adequately detect effects given the smaller than recommended sample sizes. Finally, it is necessary to note that biological processes such as

SPS can only be considered as a complementary source of behavior that works in conjunction with environmental considerations such as childhood experiences (Aron & Aron, 1997).

Authors have noted that SPS is much more than sensitivity to "puntate, physical" cues, and positive aspects such as greater depth of discrimination and increased conscientiousness are regarded as central features of SPS (Aron & Aron, 1997; Aron et al., in press). Indeed, these two orthogonal qualities of SPS have been empirically documented (Evans & Rothbart, 2008; Gearhart, 2011; Gearhart & Bodie, 2012), yet, the original 27-item Highly Sensitive Person Scale (HSPS) is a one-dimensional scale structure that seeks to measure both the positive and negative qualities of SPS. This creates a psychometric conundrum, which is indicated by confirmatory factor analyses of the single factor structure of the HSPS. Results of studies one and two, as well as previous findings (Gearhart, 2011; Gearhart & Bodie, 2012), indicate that comparative fit indices for the unidimensional scale range between .65 -.75. Thus, criticisms have been leveled against the single-factor structure on grounds that other models provide a more specified operationalization of the construct, and other factor structures have demonstrated significantly better CFA fit statistics (e.g., Smolewska, McCabe, & Woody, 2006; Evans & Rothbart, 2008).

In response to criticisms and proposed second-order factor structures (Smolewska et al., 2006), Aron et al. (in press) argue that, "results of factor analyses have been somewhat inconsistent … confirmatory factor analysis found that two- and three-factor solutions comparable with previous studies had only marginal fits (e.g., respectively, root mean square errors of approximation [RMSEAs] of .08 and .07; comparative fit indexes [CFIs] of .78 and .81)" (p. 12). Overall, it is consistent that models of the three-factor structure and one-

dimensional structure are both poor fitting and typically require the removal of multiple items (e.g., Gearhart, 2011; Gearhart & Bodie, 2012), which is where the issue becomes apparent.

The main problem is that item removal, be it from the single- or multiple factor structures, always results in the recommended deletion of items reflecting greater discriminatory ability and increased conscientiousness, those indicative of Aron's conceptually-proposed positive qualities of SPS (Aron & Aron, 1997; Evans & Rothbart, 2008; Smolewska et al., 2006). For instance, in Chapter Three, CFA results indicated the removal of 5 items, four of which reflected the aesthetic awareness aspect of trait SPS (e.g., Are you conscientious, Do you notice and enjoy delicate or fine scents, tastes, sounds, works of art).[1] The remaining 13 items utilized for statistical tests represented low sensory thresholds for stimulation (e.g., Are you easily overwhelmed by things like bright lights, strong smells, coarse fabrics, or sirens close by) and an ease of excitation (e.g., Do other people's moods affect you). Thus, after item removal, the HSPS becomes a measure of arousability and general discomfort related to high intensity stimuli—which is only half of trait SPS as conceptualized by Aron and Aron (1997).

Therefore, the finding that HSPs, as measured by the HSPS items identified in confirmatory factor analysis, appear to be more adversely affected by moderate and high levels of stimulation is not surprising considering the nature of the remaining items utilized for the SPS construct. Essentially, it becomes somewhat tautological to find that people who report being more distracted by loud noises are more distracted by loud noises, however construct validity evidence was presented in Chapter Three which suggests that, perhaps, it is not completely tautological. Indeed, when ADD is added as a covariate to ANOVA models comparing distraction scores, sensitivity moves from a significant variable in the model to being non-significant. This suggests that other factors related to SPS (or a low threshold for sensory

[1] The recommended items were nearly identical for the self-report study presented in Chapter Four.

stimulation), such as ADD, may also account for the portion of variance in non-verbal recognition errors previously accounted for by SPS. Ultimately, the full breadth of trait SPS, it appears, is difficult to measure because of its orthogonal qualities.

Recently, authors of the SPS construct and the HSPS instrument have conceded the above criticisms (Aron et al., in press). Upon examination of the four facets of sensitivity, the authors concluded that "the HSP Scale may not capture all of these facets, given how it was created empirically" (p. 15), and that "it may be valuable to refine or elaborate the sturdy HSP Scale" (p. 16). As noted at the outset of the dissertation, the HSPS was developed through interviews with people who were recruited because they were "easily overwhelmed by stimuli (such as noisy places or evocative or shocking entertainment)" (Aron et al., in press, p. 11). Thus, Aron et al. note that the emotional reactivity and sensitivity to intense stimulation aspects dominate the scale to the detriment of positive qualities of SPS, such as deeper processing. "The scale also may not capture enough behaviors directly reflecting depth of processing, which might be assessed by questions such as being slow to make decisions or behaviors reflecting heightened positive-emotional reactions. Hence, a revision of the HSP Scale may be valuable" (p. 16). Overall, what this means for the dissertation is that findings can only be considered as emanating from an HSP's tendency to become more highly stimulated and overaroused by intense stimulation—which is explicitly marked by an increase in social introversion and neuroticism as well as higher BIS reactivity scores for HSPs.

In sum, the conceptualization of trait SPS as described by Aron and Aron (1997) seems to be difficult to test via self-report because of its orthogonal dimensions. The positive and negative qualities, abilities, and consequences associated with trait SPS are well represented when looking at the face of the HSPS. Problems associated with its unidimensional fit to data

sets and the subsequent removal of items causes the misrepresentation of SPS in that positive features related to aesthetic awareness are repeatedly removed. In this study, as well as two others (Gearhart, 2011; Gearhart & Bodie, 2012), items regarding increased conscientiousness and enhanced recognition abilities are removed, and all that remain are questions regarding sensitivity to stimulation. As the authors note, however, SPS is more than simply this (Aron, 1996; Aron & Aron, 1997; Aron et al., in press), unfortunately the current measure of SPS is incapable of adequately capturing the full breadth of the construct while meeting appropriate psychometric standards. Moreover, utilization of the full measure unidimensionally disallows identification of a source of influence (i.e., positive or negative SPS) on a dependent variable from within the construct measure, or the qualities cancel each other out for a nil finding. Future research should certainly address these scale issues, a sentiment shared by Aron (Aron et al., in press).

A second general limitation of this dissertation is the small sample sizes in both studies, which are most evident in the low numbers of highly sensitive persons. Given time limitations and the percentage of HSPs projected by Aron and Aron (1997), the appropriate number of HSPs was not fully achieved for either study. For the experiment in Chapter Three, each condition was short about 12 highly sensitive persons, and as a result the power to detect differences between HSPs and non-HSPs, especially interaction effects, was reduced. For the second study, only 19 couples with highly sensitive men were identified (much fewer than the recommended 88), thus power to detect even strong effects was only .60, far beyond the level required to detect small effects. Therefore, unless the magnitude of effect was large, the current sample sizes were underpowered and would have difficulty determining even moderate effects.

Finding effects in the current study does not , however, appear to be simply a problem of small sample size; indeed, results of planned contrast and omnibus ANOVA tests indicate that effect sizes for SPS on output variables (i.e., distraction, non-verbal decoding errors) ranged between .00 and .03 (facial expression test). These values, while statistically significant, are practically insignificant. Thus, while distinctions between HSPs and non-HSPs do seem to exist, individually and in relationships, these differences seem to be more negative for HSPs and the magnitude of effect is negligible at best. Indeed, in study 1, differences in errors between HSPs and non-HSPs were only to the magnitude of approximately 1.5 more errors per 72 responses. And for study 2, only one dependent variable was significant with respect to relational behaviors. These findings certainly do not reflect a large influence of SPS on inferential accuracy or affect management behaviors, and suggest that trait SPS may be of little influence in actual interactions. Given that the laboratory experiment provides diminished ecological validity for determining or generalizing any practical influence on actual human interactions, and self-report research is restricted in its depth and breadth, future research should extend the current studies to incorporate more natural behavior.

Finally, no considerations in the current research project were given to the noted interaction of negative childhood experiences and high sensory-processing sensitivity (Aron & Aron, 1997). Indeed, it was noted that there "appear to be two distinct groups of highly sensitive persons" (p. 363), and that "about one third of the highly sensitive individuals, reported childhoods that were substantially more troubled" (p. 363). Ultimately, sensitive persons reporting troubled childhoods are more introverted and shy than those reporting relatively normal childhoods (Aron & Aron, 1997; Aron et al., in press), thus contributing to differences in the influence of SPS on an individual as an adolescent or adult. The observation that some people

are genetically more vulnerable than others to the effects of stress and genetic qualities has been recognized (see Aron et al., in press for review of studies related to SPS), however this stance is in opposition to the premises of communibiology (Beatty, McCroskey, & Pence, 2009) outlined in Chapter Two. This dissertation does not agree with the fourth premise of communibiology that disregards most influence of environment (20%; Beatty & McCroskey, 2000), and the exclusion of childhood experience as a potential confounding variable was not to acknowledge or support such a rigid contention. Rather, the scope of the project and the dependent variables of interest, in particular for the experiment in study 1, did not necessitate or warrant such environmental considerations as negative childhood experiences. While environment is accounted for with respect to physical surroundings, it should be acknowledged that any findings (or non-findings) regarding differences between HSPs and non-HSPs do not consider or account for the role of childhood experience, thus creating a direction for future research.

## Future Research

To address some of the limitations explicated above as well as untested propositions from Chapter Two, a number of future research projects are proposed. With respect to study 1, using single modality tests of inferrential accuracy as well as actors and actresses reading scripted statements and posing for still images reduced the ecological validity of findings. Primarily, the tests of non-verbal decoding used in this dissertation limited the number of cues from which participants could make inferential judgments about feelings. While non-HSPs are subjected to the same limitation, the prediction may not be fully supported because the maximum benefits of SPS are not recognized in such an objective test. That is, HSPs are considered more intuitive towards the feelings of others because of a greater ability to simultaneously process and draw connections between cues (Aron, 1996). Thus, the lack of a gestalt body of sensory information

leaves little room for HSPs to more deeply process subtle social or emotional information leaked during interaction. Other tests of emotion recognition accuracy may provide a better understanding of the actual differences between HSPs and non-HSPs with respect to interpersonal sensitivity to expressions of emotions. Tests like the Interpersonal Perception Task (Costanzo & Archer, 1989), which includes full-channel video recordings of persons interacting in various ways may provide a more robust test of the inferential accuracy abilities of HSPs versus non-HSPs.

Aside from simply watching the interactions of strangers or self-reporting behaviors, studies may approach interpersonal sensitivity from a perspective more similar to the empathic accuracy paradigm (Ickes, 1999). This would include HSPs participating in a live interaction with another individual, after which both participants complete post-treatment surveys to report how they felt and their perceptions of how the other interactant felt. After re-watching the interaction they would then re-assess their thoughts regarding the feelings of the other person. Possibly, HSPs are less accurate after the initial interaction because stimulation arising from the novelty of the situation, yet upon review of the interaction they are more aware and attuned to the cues of the other individual than are non-HSPs.

Differences in context may also be appropriate avenues for study. For instance, if HSPs spend more time processing sensory cues from and information about a stranger, then initial interactions may be affected in either positive or negative ways. As suggested before, HSPs might shut down and become behaviorally or socially inhibited, thus being perceived as introverted or shy. On the other hand, greater awareness of others could make HSPs better listeners and more likely to ask questions (a noted function of better listening; Bodie, St. Cyr, Pence, Rold, & Honeycutt, 2012), thus allowing them to make more favorable social

impressions. Additionally, recordings of couples who are asked to discuss some of their biggest complaints or common disagreements may provide a richer understanding of how highly sensitive persons respond to conflict or arousing relationship discussions. Since Aron (1996) posits a number of claims regarding specific behaviors associated with the influence of SPS on conflict management, such as withdrawal, stonewalling, or evaluating comments too negatively, these predominately negative behaviors may be best measured behaviorally rather than by self-report. Recording and coding these types of discussions, in order to draw comparisons between the conflict management behaviors of highly sensitive persons and non-sensitives provides a much richer investigation into the actual relational effects of SPS than the self-report study detailed in this research project.

Aron (1996) claims that HSPs are likely to prepare for relational conflict by rehearsing the interactions in their mind, stating that when anticipating conflict, HSPs "in a very real, arousing, semiconscious imaginary world, are already experiencing various ways the conversation might go, and most of them are distressing" (p. 156). Thus, an interesting area of future research for SPS is the examination of differences in social cognitions and imagination between HSPs and non-HSPs. In particular, the phenomena of imagined interactions is considered a common intrapersonal behavior for almost all people (Honeycutt, 2003), but there are specific attributes of II that Aron implicitly hints to. For instance, the quote suggests attributes such as vividness and negative valence are a part of HSPs conflict management IIs. Valence refers to the diversity and direction (positive or negative) of emotions that are experienced while envisioning conversation (Honeycutt, 2009), and specificity reflects the level of detail and distinction of images contained within IIs. Thus, it may be that HSPs would report

greater specificity and more negative valence than non-HSPs when IIs regarding a future conflict are induced in participants.

Finally, a number of propositions that were proposed in Chapter Two were beyond the scope and boundaries of the current dissertation. Thus, future research could address any of the following propositions: if HSPs are more prone to experience sensory discomfort under moderate stimulation, then they will be more likely to avoid such situations (Proposition 10); if inhibited behavior causes HSPs to avoid stimulating situations and highly arousing activities, then this inhibition prohibits engaging in types of shared experiences that enhance relational quality, and HSP relationships may be at risk of becoming unexciting and of low quality (Proposition 8); and, if deeper processing contributes to cognitive backlog, then exposure to multiple or intense stimuli will cause HSPs to experience perform more poorly during reading or listening comprehension tasks (Proposition 6). The possible interpersonal and information processing effects only represent a small part of the far-reaching influence of SPS on communication behaviors, skills, and outcomes.

## Conclusion

This dissertation contributes to the existing literature about biological influences on communication by testing the possible effects of one specific neurological trait, SPS, on a host of abilities and behaviors related to interpersonal communication. Furthermore, this research project provides full or partial empirical support for several of the undocumented claims made by Aron (1996, 2000; Aron & Aron, 1997), but fails to find support for others. Importantly, SPS as measured in this dissertation does not entirely reflect its original conceptualization (Aron & Aron, 1997) and any identified effects can be attributed to greater ease of excitation to stimulation and higher emotional reactivity. Moreover, effects observed in this research project

appear to be very small, suggesting the influence of SPS on some abilities and behaviors is practically negligible.

Findings indicate that HSPs experience greater levels of distraction when exposed to moderate and high stimulation, and this arousal contributes to lower accuracy when making judgments about the emotional expressions of posed and recorded social actors. Without stimulation present, HSPs do not appear to be more accurate than non-HSPs at decoding tests, as supposed by their greater discriminatory ability (Jagiellowicz et al., 2011). With respect to males, HSM do not appear to conform more to American norms of masculinity, but do experience greater gender role conflict and stress, possibly because they fail to meet societal expectations.

The findings of this dissertation offer support for several theoretical perspectives which were used to as explanatory mechanisms for the claims made by Aron (1996, 2000; Aron & Aron, 1997). As predicted by Diffuse Physiological Arousal theory (Gottman, 1990), because of increased arousal from moderate and high intensity noise stimulation causes HSPs to perform worse (i.e., more errors) on tests of non-verbal decoding ability. As suggested and explained by the gender strain paradigm (Pleck, 1995), because HSPs are more likely to fail to meet American norms of masculinity they experience greater gender role conflict and stress, however conformity is not the primary explanation for this relationship as models failed to reach acceptable fit criteria.

Methodologically, this study offered a critique of the existing SPS measure that focused on the difficulty of measuring a single construct with orthogonal qualities. The SPS measure appears to best represent arousability aspects of high sensory-processing sensitivity. Also, audio stimulation was found to be a better manipulation for experiments because it offers researchers

greater control than does visual stimulus. Thus, future research projects considering stimulation treatment conditions should consider audio recordings to avoid difficulties associated with other modalities (e.g., lingering smells).

As future research projects refine the self-report measure of SPS to better reflect its multiple qualities, as medical studies develop a greater understanding of the neurological structures and systems that are important to sensory-processing, and as future investigations into the intrapersonal and interpersonal consequences of SPS continue to expand the focus on possible communicative outcome of SPS, I can better come to understand and predict how and why my dad (and I) will behave.

## REFERENCES


Acevedo, B., Aron, A., & Aron, E. N. (2010, August). *Association of sensory processing sensitivity when perceiving positive and negative emotional states.* Paper presented at the annual convention of the American Psychological Association, San Diego, CA.

Ahadi, B., & Basharpoor, S. (2010). Relationship between sensory-processing sensitivity, personality dimensions, and mental health. *Journal of Applied Sciences, 10*, 570-574. doi: 10.3923/jas.2010.570.574

Arellano, C. M., & Markman, H. J. (1995). The Managing Affect and Differences Scale (MADS): A self-report measure assessing conflict management strategies in couples. *Journal of Family Psychology, 9*, 319–334. doi: 10.1037/0893-3200.9.3.319

Aron, E. N. (1996). *The highly sensitive person.* New York, NY: Broadway.

Aron, E. N. (2000). *The highly sensitive person in love.* New York, NY: Broadway.

Aron, A., & Aron, E. N. (1996). Self and self-expansion in relationships. In G. J. O. Fletcher & J. Fitness (Eds.), *Knowledge structures in close relationships: A social psychological approach* (pp. 325-344). Mahwah, NJ: Erlbaum.

Aron, E. N., & Aron, A. (1997). Sensory-processing sensitivity and its relation to introversion and emotionality. *Journal of Personality and Social Psychology, 73*, 345-368. doi: 10.1037/ 0022-3514.73.2.345

Aron, E. N., Aron, A., & Davies, K. M. (2005). Adult shyness: The interaction of temperamental sensitivity and an adverse childhood environment. *Personality and Social Psychology Bulletin, 31*, 181-197. doi: 10.1177/0146167204271419

Aron, E. N., Aron, A., & Jagiellowicz, J. (in press). Sensory processing sensitivity: A review in the light of the evolution of biological responsivity. *Personality and Social Psychology Review.* doi: 10.1177/108886831143421.

Aron, A., Norman, C. C., Aron, E. N., McKenna, C., Heyman, R. E. (2000). Couples' shared participation in novel and arousing activities and experienced relationship quality. *Journal of Personality and Social Psychology, 78*, 273-284. doi: 10.1037/0022-3514.78.2.273

Aron, A., Ketay, S., Hedden, T., Aron, E. N., Markus, H. R., & Gabrieli, J. D. E. (2010). Temperament trait of sensory processing sensitivity moderates cultural differences in neural response. *Social Cognitive and Affective Neuroscience, 5*, 219-226. doi: 10.1093/scan/nsq028

Babrow, A. S. (2005). Point, counterpoint, to the side of the point, and other points of interest in the latest debate about communibiological theory: A response to Nelson, McCroskey, and Beatty. *Communication Theory, 15,* 475-484. doi: 10.1111/j.1468-2885.2005.tb00346.x

Beatty, M. J. (1981). Receiver apprehension as a function of cognitive backlog. *Western Journal of Speech Communication, 45*, 277-281. doi: 10.1080/10570318109374049

Beatty, M.J., & McCroskey, J.C. (1997). It's in our nature: Verbal aggressiveness as temperamental expression. *Communication Quarterly*, *45*, 446-460. doi: 10.1080/01463379709370076

Beatty, M. J., & McCroskey, J. C. (2000). A few comments about communibiology and the nature/nurture qustion. *Communication Education, 49*, 25-28.

Beatty, M. J., McCroskey, J. C., & Heisel, A. D. (1998). Communication apprehension as temperamental expression: A communibiological paradigm. *Communication Monographs, 65,* 197-219. doi: 10.1080/03637759809376448

Beatty, M. J., Marshall, L. A., & Rudd, J. E. (2001). A twins study of communicative adaptability: Heritability of individual differences. *Quarterly Journal of Speech, 87,* 366-377. doi: 10.1080/00335630109384346

Beatty, M. J., McCroskey, J. C., & Pence, M. E. (2009). Communibiological paradigm. In M. J. Beatty, J. C. McCroskey, & K. Floyd (Eds.), *Biological dimensions of communication: Perspectives, methods, and research* (pp. 3-16). Cresskill, NJ: Hampton Press.

Bem, S. L. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42,* 155–162. doi: 10.1037/h0036215

Benham, G. (2005). The highly sensitive person: Stress and physical symptom reports. *Personality and Individual Differences, 40,* 1433-1440. doi: 10.1016/j.paid.2005.11.021 1434.

Bernieri, F. J. (2001). Toward a taxonomy of interpersonal sensitivity. In J. A. Hall & F. J. Bernieri (Eds.), *Interpersonal sensitivity: Theory and measurement* (pp. 3–20). Mahwah, NJ: Erlbaum.

Bodie, G. D. (2011). The Active-Empathic Listening Scale (AELS): Conceptualization and evidence of validity with the interpersonal domain. *Communication Quarterly, 59,* 277-295. doi: 10.1080/01463373.2011.583495

Bodie, G. D. (2012). Listening as positive communication. In T. Socha & Pitts, M. (Eds.), *The Positive Side of Interpersonal Communication* (pp. 109-125). New York, NY: Peter Lang.

Bodie, G. D., Vickery, A. J., & Gearhart, C. C. (in press). The nature of supportive listening I: Exploring the relation between supportive listeners and supportive people. *International Journal of Listening.*

Bodie, G. D., St. Cyr, K., Pence, M., Rold, M., & Honeycutt, J. M. (2012). Listening competence in initial interactions I: Distinguishing between what listening is and what listeners do. *International Journal of Listening, 26,* 1-28. doi: 10.1080/10904018.2012.639645

Boren, J. P., & Veksler, A. E. (2011). The brain, nervous, endocrine, cardiovascular, and immune systems: A decade of research exploring biology and communication. *Communication Research Trends, 30*(4), 1 – 31.

Buhrmester D. (1990) Intimacy of friendship, interpersonal competence, and adjustment during preadolescence and adolescence. *Child Development, 61,* 1101–1111. doi: 10.1111/j.1467-8624.1990.tb02844.x

Burns, S.M., & Mahalik, J.R. (2008). Sexual functioning as a moderator of the relationship between masculinity and men's adjustment following treatment for prostate cancer. *American Journal of Men's Health, 2*, 6-16. doi: 10.1177/1557988307304325

Byrne, B. M. (2010). *Structural equation modeling with AMOS* (2nd ed.). Ottawa, Ontario, Canada: Routledge.

Carton, J. S., Kessler, E. A., & Pape, C. L. (1999). Nonverbal decoding skills and relationship well-being in adults. *Journal of Nonverbal Behavior, 23*, 91-100. doi: 10.1023/A:1021339410262

Carver, C. S., & White, T. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology, 67*, 319–333. doi: 10.1037/0022-3514.67.2.319

Cassepp-Borges, V., & Pasquali, L. (2011). Relationship Assessment Scale's psychometric characteristics. *Psico-USF*, 16, 255-264. doi: 10.1590/S1413-82712011000300002

Cheek, J. M., & Buss, A. H. (1981). Shyness and sociability. *Journal of Personality and Social Psychology, 41,* 330–339. doi: 10.1037/0022-3514.41.2.330

Ciarrochi, J., Chan, A., & Caputi, P. (2000). A critical evaluation of the emotional intelligence construct. *Personality and Individual Differences, 28*, 539-561. doi: 10.1016/S0191-8869(99)00119-1

Costanzo, M., & Archer, D. (1989). Interpreting the expressive behavior of others: The Interpersonal Perception Task. *Journal of Nonverbal Behavior, 13,* 225–245. doi: 10.1007/BF00990295

Creasey, G., Kershaw, K., & Boston, A. (1999). Conflict management with friends and romantic partners: The role of attachment and negative mood regulation expectancies. *Journal of Youth and Adolescence, 28,* 523–543. doi: 10.1111/j.1532-7795.2004.01402005.x

Creasey, G., & Hesson-McInnis, M. (2001). Affective responses, cognitive appraisals, and conflict tactics in late adolescent romantic relationships: Associations with attachment orientations. *Journal of Counseling Psychology, 48,* 85–96. doi: 10.1037/0022-0167.48.1.85

Davis, M. H., & Oathout, H. A. (1987). Maintenance of satisfaction in romantic relationships: Empathy and relational competence. *Journal of Personality and Social Psychology, 53,* 397–410. doi: 10.1037/0022-3514.53.2.397

DeYoung, C. G. (2006). Higher-order factors of the Big Five in a multi-informant sample. *Journal of Personality and Social Psychology, 91*, 1138-1151. doi: 10.1037/0022-3514.91.6.1138

Drollinger, T., Comer, L. B., & Warrington, P. T. (2006). Development and validation of the active empathetic listening scale. *Psychology and Marketing, 23,* 161-180. doi: 10.1002/mar.20105

Duval, T. S., & Wicklund, R. A. (1972). *A theory of objective self-awareness.* New York: Academic.

Ekman, P., & Friesen, W. V. (1969). Nonverbal leakage and clues to deception. *Psychiatry, 32***,** 88–105.

Erhart, M., Dopfner, M., & Ravens-Sieberer, U. (2008). Psychometric properties of two ADHD questionnaires: Comparing the Conners' scale and the FBB-HKS in the general population of German children and adolescents – results of the BELLA study. *European Child & Adolescent Psychiatry*, *17,* 106-115.

Evans, D. E., & Rothbart, M. K. (2008). Temperamental sensitivity: Two constructs or one? *Personality and Individual Differences, 44,* 108-118. doi: 10.1016/j.paid.2007.07.016

Evers, A., Rasche, J., & Schabracq, M. J. (2008). High sensory-processing at work. *International Journal of Stress Management, 15*, 189-198. doi: 10.1037/1072-5245.15.2.189

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41,* 1149-1160. doi: 10.3758/BRM.41.4.1149

Frazier, T. W., Youngstrom, E. A., Glutting, J. J., & Watkins, M. W. (2007). AHDH and achievement: Meta-analysis of the child, adolescent, and adult literatures and a concomitant study with college students. *Journal of Learning Disabilities, 40*, 49-65. doi: 10.1177/00222194070400010401

Furnham, A. (1986). Response bias, social desirability and dissumulation. *Personality and Individual Differences, 7,* 385-400. doi: 10.1016/0191-8869(86)90014-0

Garland, M., & Haas, J. W. (2011, November). *Examining student differences in the oral communication classroom: An exploration of the impact of student sensitivity on learning outcomes.* Paper presented at the annual meeting of the National Communication Association, New Orleans, LA.

Gearhart, C. C. (2011). The impact of sensory-processing sensitivity on communication: A preliminary self-report study. Manuscript submitted for publication.

Gearhart, C. C., & Bodie, G. D. (2011). Active-empathic listening as a general social skill: Evidence from bivariate and canonical correlations. *Communication Reports, 24,* 86-98. doi:10.1080/08934215.2012.672216

Gearhart, C. C., & Bodie, G. D. (2012). Sensory-processing sensitivity and communication apprehension: Dual influences on self-reported stress in a college student sample. *Communication Reports, 25,* 27-39. doi: 10.1080/08934215.2012.672216

Glonek, K., Nash, E., Shields, V., Sawyer, C. R. & Behnke, R. R. (2007, November). *Communication adaptability as a function of nervous system mobility and sensory-processing sensitivity.* Paper presented at the annual meeting of the National Communication Association, Chicago, IL.

Goldsmith, D. J., & Fulfs, P. A. (1999) 'You just don't have the evidence': An analysis of claims and evidence in Deborah Tannen's *You just don't understand*. In M. E. Roloff (Ed.), *Communication Yearbook 22* (pp. 1-49). Thousand Oaks, CA: Sage.

Good, G. E., Robertson, J. M., O'Neil, J. M., Fitzgerald, L. F., Stevens, M., DeBord, K. A., … Braverman, D. G. (1995). Male gender role conflict: Psychometric issues and relations to psychological distress. *Journal of Counseling Psychology, 42,* 3-10. doi: 10.1037/0022-0167.42.1.3

Gottman, J. (1990). How marriages change. In G. R. Patterson (Ed.), *Depression and aggression in family interaction* (pp. 75-102). Hillsdale, NJ: Erlbaum.

Gray, J. A. (1982). *The neuropsychology of anxiety*. London, England: Oxford University Press.

Gray, J. A. (1991). The neuropsychology of temperament. In J. Strelau & A. Angleitner (Eds.), *Explorations in temperament* (pp. 105-128). New York, NY: Plenum.

Gray, J. A., & Naughton, N. (2000). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system*. Oxford, England: Oxford University Press.

Gross, J. J., & John, O. P. (1997). Revealing feelings: Facets of emotional expressivity in self-reports, peer ratings, and behavior. *Journal of Personality and Social Psychology, 72*, 435-448. doi: 10.1037/0022-3514.72.2.435

Hall, J. A., Andrzejewski, S. A., & Yopchick, J. E. (2009). Psychosocial correlates of interpersonal sensitivity: A meta-analysis. *Journal of Nonverbal Behavior, 33*, 149-180. doi: 10.1007/s10919-009-0070-5

Hall, J. A., Carter, J. D., & Horgan, T. G. (2001). Status roles and recall of nonverbal cues. *Journal of Nonverbal Behavior, 25*, 79–100. doi: 10.1023/A:1010797627793

Hendrick, S. S. (1988). A generic measure of relationship satisfaction. *Journal of Marriage & the Family, 50*(1), 93-98. doi: 10.2307/352430

Heubeck, B. G., Wilkinson, R. B., & Cologon, J. (1998). A second look at Carver and White's (1994) BIS/BAS scales. *Personality and Individual Differences, 25*, 785–800. doi: 10.1016/S0191-8869(98)00124-X

Hofmann, S. G., & Bitran, S. (2007). Sensory-processing sensitivity in social anxiety disorder: Relationship to harm avoidance and diagnostic subtypes. *Journal of Anxiety Disorders, 21*, 944-954. doi: 10.1016/j.janxdis.2006.12.003

Honeycutt, J. M. (2003). *Imagined interactions: Daydreaming about communication.* Cresskill, NJ: Hampton Press.

Honeycutt, J. M. (2009). *Imagine that: Studies in Imagined Interaction*. Cresskill, NJ: Hampton Press.

Horvath, C. W. (1995). Biological origins of communicator style. *Communication Quarterly, 43*, 394-407. doi: 10.1080/01463379509369987

Hoyle, R. H. (2000). Confirmatory factor analysis. In H. E. Tinsley & S. D. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modeling* (pp. 465-498). San Diego, CA: Academic Press.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55. doi: 10.1080/10705519909540118

Ickes, W., Buysse, A., Pham, H., Rivers, K., Erickson, J. R., Hancock, M., et al. (2000). On the difficulty of distinguishing ''good'' and ''poor'' perceivers: A social relations analysis of empathic accuracy data. *Personal Relationships, 7*, 219–234. doi: 10.1111/j.1475-6811.2000.tb00013.x

Jagiellowicz, J., Xu, X., Aron, A., Aron, E. N., Cao, G., Feng, T., & Weng, X. (2011). Sensory-processing sensitivity and neural responses to changes in visual scenes. *Social Cognitive and Affective Neuroscience, 6,* 38-47. doi: 1093/scan/nsq001

John, O. P., Donahue, E. M., & Kentle, R. L. (1991*). The Big Five Inventory--Versions 4a and 5a.* Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research.

Kanwisher, N., Woods, R.P., Iacoboni, M., Mazziotta, J.C. (1997). A locus in human extrastriate cortex for visual shape analysis. *Journal of Cognitive Neuroscience, 9,* 133–42. doi: 10.1162/jocn.1997.9.1.133

Kimmel, M. S. (2004). Masculinity as homophobia: Fear, shame, and silence in the construction of gender identity. In P. F. Murphy (Ed.), *Feminism and masculinities* (pp. 182-199). New York, NY: Oxford Press.

Kimmel, M. S., Hearn, J., & Connell, R. W. (2005). *Handbook of studies on men and masculinities*. Thousand Oaks, CA: Sage.

Kirzinger, A. E., Weber, C., & Johnson, M. (2012). Genetic and environmental influences on media use and communication behaviors. *Human Communication Research, 38,* 144-171.

Kagan, J. (1994). *Galen's prophecy: Temperament in human nature*. New York, NY: Basic Books.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York, NY: Guilford.

Leone, L., Perugini, M., Bagozzi, R. P., Pierro, A., & Mannetti, L. (2001). Construct validity and generalizability of the Carver–White Behavioural Inhibition System/Behavioural Activation System scales. *European Journal of Personality*, *15*(5), 373-390. doi: 10.1002/per.415

Levine, T. R. (2005). Confirmatory factor analysis and scale validation in communication research. *Communication Research Reports, 22,* 335-338. doi: 10.1080/00036810500317730

Lipsky, S., Caetano, R., Field, C. A., & Larkin, G. L. (2006). The role of intimate partner violence, race, and ethnicity in help-seeking behaviors. *Ethnicity and Health, 11,* 81-100. doi: 10.1080/13557850500391410

Liss, M., Timmel, L., Baxley, K., & Killingsworth, P. (2005). Sensory-processing sensitivity and its relation to parental bonding, anxiety, and depression. *Personality and Individual Differences, 39,* 1429-1439. doi: 10.1016/j.paid.2005.05.007

Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modeling, 9,* 151-173. doi: 10.1.1.118.6289

Mahalik, J.R., Locke, B., Ludlow, L., Diemer, M., Scott, R.P.J., Gottfried, M., & Freitas, G. (2003). Development of the Conformity to Masculine Norms Inventory. *Psychology of Men and Masculinity, 4,* 3-25. doi: 10.1037/1524-9220.4.1.3

Maslach, C. (1993). Professional burnout: Recent developments in theory and research. In B. Wilmar, C. Maslach., & M. Tadeusz (Eds.), *Series in applied psychology: Social issues and questions* (pp. 19-32). Philadelphia, PA: Taylor & Francis.

Mayer, J. D., DiPaolo, M. & Salovey, P. (1990). Perceiving affective content in ambiguous visual stimuli: A component of emotional intelligence. *Journal of Personality Assessment, 54,* 772-781. doi: 10.1080/00223891.1990.9674037

McCrae, R. R., Costa Jr., P. T., Ostendorf, F., Angleitner, A., Hrebickova, M., Avia, M. D., Sanz, J., … Smith, P. B. (2000). Nature over nurture: Temperament, personality, and life span development. *Journal of Personality and Social Psychology, 78,* 173-186. doi: 10.1037/0022-3514.78.1.173

McCroskey, J. C. (1977). Oral communication apprehension: A summary of recent theory and research. *Human Communication Research, 4,* 75-96. doi: 10.1111/j.14682958.1977.tb00599.x

McCroskey, J. C. (1984). The communication apprehension perspective. In J. A. Daly & J. C. McCroskey (Eds.), *Avoiding communication: Shyness, reticence, and communication apprehension* (pp. 13-38). Beverly Hills, CA: Sage.

McCroskey, J.C., & Beatty, M.J. (1998). Communication apprehension. J. C. McCroskey, J. A. Daly, M. M. Martin, & M. J. Beatty, (Eds.), *Communication and personality,* (pp. 215-231). Cresskill, NJ: Hampton Press.

McIntire, K. A., Danforth, M. M., & Schneider, H. G. (1997, April). *Measuring cue perception: Assessment of reliability and validity.* Poster presented at the annual convention of the Southeastern Psychological Association, Atlanta, GA.

Mehrabian, A. (1976). *Manual for the questionnaire measure of stimulus screening and arousability*. Los Angeles, CA: UCLA.

Mullett, E., & Stolberg, A. L. (2002). Divorce and its impact on the intimate relationships of young adults. *Journal of Divorce and Remarriage, 38,* 39-59. doi: 10.1300/J087v38n01_03

Nelson, C. K. (2004). Classifying communibiology's texts: Implications for genre theory. *Communication Theory, 14,* 142-166. doi: 10.1111/j.1468-2885.2004.tb00309.x

Nowicki, S., Jr. (1995). *A study of the DANVA AP in college students*. Unpublished manuscript. Department of Psychology, Emory University, Atlanta, GA.

Nowicki, S. Jr., & Carton, J. (1993). The measurement of emotional intensity from facial expressions: The DANVA FACES 2. *Journal of Social Psychology, 133*, 749-750. doi: 10.1080/00224545.1993.9713934

Nowicki, S., & Duke, M. P. (1994). Individual differences in the nonverbal communication of affect: The Diagnostic Analysis of Nonverbal Accuracy scale. *Journal of Nonverbal Behavior, 18*, 9–35. doi: 10.1007/BF02169077

Nowicki, S., & Duke, M. P. (2001). Nonverbal receptivity: The Diagnostic Analysis of Nonverbal Accuracy (DANVA). In J. A Hall & F. J. Bernieri (Eds.), *Interpersonal sensitivity: Theory and measurement* (pp. 183–198). Mahwah, NJ: Erlbaum.

O'Neil, J. M. (2008). Summarizing twenty-five years of research on men's gender-role conflict using the gender role conflict scale: New research directions and clinical implications. *The Counseling Psychologist, 36*, 358-445.

O'Neil, J. M., Helms, B., Gable, R., David, L., & Wrightsman, L. (1986). Gender Role Conflict Scale: College men's fear of femininity. *Sex Roles, 14*, 335–350. doi: 10.1007/BF00287583

O'Neil, J. M., Good, G. E., & Holmes, S. (1995). Fifteen years of theory and research on men's gender role conflict: New paradigms for empirical research. In R. Levant & W. Pollack (Eds.), *The new psychology of men* (pp. 164-206). New York, NY: Basic.

\

Owen, J. (2011). Assessing the factor structures of the 55- and 22-item versions of the Conformity to Masculine Norms Inventory. *American Journal of Men's Health, 5*, 118-128. doi: 10.1177/1557988310363817

Parent, M. C., & Moradi, B. (2011). An abbreviated tool for assessing conformity to masculine norms: Psychometric properties of the Conformity to Masculine Norms Inventory-46. *Psychology of Men & Masculinity, 12*, 339-353. doi: 10.1037/a0021904

Pitterman, H., & Nowicki, S. J. (2004). A test of the ability to identify emotion in human standing and sitting postures: The Diagnostic Analysis of Nonverbal Accuracy-2 Posture test (DANVA-2-POS). *Genetic, Social, and General Psychology Monographs, 130*, 146–162.

Pleck, J. H. (1995). The gender role strain paradigm: An update. In R. F. Levant & W. S. Pollack (Eds.), *A new psychology of men* (pp. 11-32). New York, NY: Basic.

Purdy, M. (2006, April). *Listening and gender: Stereotypes and explanations.* Paper presented at the International Listening Association annual convention, Salem, OR.

Raykov, T., & Marcoulides, G. A. (2006). *A first course in structural equation modeling* (2nd ed.). Mahwah, NJ: Erlbaum.

Reissman, C, Aron, A., & Bergen, M. R. (1993). Shared activities and marital satisfaction: Causal direction and self-expansion versus boredom. *Journal of Social and Personal Relationships, 10*, 243-254. doi: 10.1177/026540759301000205

Reynolds, C. R., & Kamphaus, R. W. (2004). *Behavior Assessment System for Children, Second Edition (BASC-2).* Circle Pines, MN: American Guidance Service.

Robin, A. L., & Vandermay, S. J. (1996). Validation of a measure for adolescent self-report of Attention Deficit Disorder Symptoms. *Developmental and Behavioral Pediatrics, 17,* 212-215.

Rochlen, A. B., McKelley, R. A., Suizzo, M., & Scaringi, V. (2008). Predictors of relationship satisfaction, psychological well-being, and life satisfaction among stay-at-home fathers. *Psychology of Men & Masculinity, 9,* 17–28. doi: 10.1037/1524–9220.9.1.17

Rohsenow, D. J., & Niaura, R. S. (1999). Reflections on the state of cue-reactivity theories and research. *Addiction, 94*, 343-344. doi: 10.1080/09652149933838

Ross, S. R., Millis, S.R., Bonebright, T. L., & Bailley, S. E. (2002). Confirmatory factor analysis of the Behavioral Inhibition and Activation Scales. *Personality and Individual Differences, 33,* 861– 865. doi: 10.1016/S0191-8869(01)00196-9

Rothbart, M. K., Ahadi, S. A., & Evans, D. E. (2000). Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology, 78,* 122-135. doi: 10.1037/0022-3514.78.1.122

Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition, and Personality, 9,* 185-211. doi: 10.1016/j.paid.2003.11.014

Sax, L. J., Gilmartin, S. K., & Brynat, A. N. (2003). Assessing response rates and nonresponsive bias in web and paper surveys. *Research in Higher Education, 44,* 40-432. doi: 0361-0365/03/0800-0409/0

Scherer, K. R., Banse R., Wallbott H. G., & Goldbeck T. (1991). Vocal cues in emotion encoding and decoding. *Motivation and Emotion, 15*, 123-148. doi: 10.1007/BF00995674

Silvia, P. J., & Duval, T. S. (2001). Objective self-awareness theory: Recent progress and enduring problems. *Personality and Social Psychology Review, 5,* 230-241. doi: 10.1207/S15327957PSPR0503_4

Smolewska, K., McCabe, S., & Woody, E. (2006). A psychometric evaluation of the Highly Sensitive Person Scale: The components of sensory-processing sensitivity and their relation to the BIS/BAS and 'Big Five'. *Personality and Individual Differences, 40,* 1269-1279. doi: 10.1016/j.paid.2005.09.022

Stelmack, R. M., & Campbell, K. B. (1974). Extraversion and auditory sensitivity to high and low frequency. *Perceptual and Motor Skills, 38,* 875-879. doi: 10.1016/0191-8869(82)90003-4

Strelau, J. (1987). The concept of temperament in personality research. *European Journal of Personality, 1,* 107-117. doi: 10.1002/per.2410010205

Thomas, A., & Chess, S. (1977). *Temperament and development*. New York, NY: Brunner/Mazel.

Underwood, D., Kim, H., & Matier, M. (2000, May). *To mail or to Web: Comparisons of survey response rates and respondent characteristics*. Paper presented at the 40th Annual Forum of the Association for Institutional Research, Cincinnati, OH.

Valencic, K. M., Beatty, M. J., Rudd, J. E., Dobos, J. A., & Heisel, A. D. (1998). An empirical test of a communibiological model of trait verbal aggressiveness. *Communication Quarterly, 46,* 327-341. doi: 10.1080/01463379809370105

Wagner, H. L. (1993). On measuring performance in category judgment studies of nonverbal behavior. *Journal of Nonverbal Behavior, 17,* 3–28. doi: 10.1007/BF00987006

Wheeless, L. (1975). An investigation of receiver apprehension and social context dimensions of communication apprehension. *Speech Teacher, 24,* 261-268. doi: 10.1080/03634527509378169

## APPENDIX A: PILOT STUDY

In order to determine which type of sensory manipulation provided the most effective and significant change in reported feelings of distraction, two sensory cue types were tested at three levels of intensity. Cue type was a between-subjects factor and stimulation intensity was a within-subjects variable. Students first completed an online pre-treatment survey measuring their levels of sensory-processing sensitivity and then were randomly assigned to one of two experimental conditions which provided either visual or audio stimulation (between-subjects). As students from each group moved through three independent computer stations, levels of stimulation intensity were produced such that each participant was exposed to a level of high, moderate, and low stimulation intensity (within-subjects). A Latin square design was used to examine possible sequencing effects of the patterns of stimulation administration (i.e., high-moderate-none, moderate-high-none, etc.). At each of the three independent computer stations respondents completed a short, unrelated computer activity that included manipulation check questions to assess participants' level of distraction. These scores were compared between the types of stimulations, between intensities of stimulation, and between groups of highly sensitive students and non-sensitive students.

It is necessary to test for the proper type of stimulation because no empirical evidence surrounding sensory-processing sensitivity (SPS) (Aron & Aron, 1997) has been produced comparing levels of stimulation across various modalities. Aron states that the "difference in arousability … is true whether we are talking about subtle sounds, sights, or physical sensations like pain" (Aron, 1996, p. 7). In question is whether highly sensitive persons are equally distracted by levels of audio and visual stimulation, as pain would not be a proper manipulation to assess for the purposes of this study. The "best" or most effective manipulation will produce a

linear effect such that reports of distraction increase noticeably between each of the three intensity conditions. Thus, the following research question:

RQ1: Which set of stimulus material produces the best pattern of distraction scores?

Furthermore, it has yet to be demonstrated that highly sensitive persons (HSPs) are more overwhelmed by moderate and high levels of stimulation, a key claim of Aron (1996). "What is moderately arousing for most people is highly arousing for HSPs. What is highly arousing for most people causes an HSP to become very frazzled indeed" (p. 7). Sirens, strange odors, and crowds are examples of mid-level sensory stimulations that have been suggested to be more noticeable and distracting for HSPs than non-sensitive persons. Aron speculates that a hyper-awareness of one's surroundings and an inherent predisposition to more deeply process extraneous stimuli in one's environment cause HSPs to become mentally taxed and overly aroused by moderate stimulation. Therefore, in order to determine if HSPs are differentially affected by such level of stimulation the following research question is posed:

RQ2: Do differences in distraction score patterns exist between HSPs and non-HSPs or are the two groups similarly influenced by high, moderate, and low stimulation?

## Method

### General Setup

This experiment utilized a 2 (stimulus mode: visual, audio) X 2 (HSPS self-reported sensitivity: high, low) X 3 (stimulation intensity: low, moderate, high) mixed design; the first two factors were between-subjects, while the last factor was within-subjects. G*Power 3.1(Faul, Erdfelder, Buchner, & Lang, 2009) was utilized to determine necessary sample size requirements for an analysis of variance with repeated measures. In order to find moderate effects (.30+) at the .05 significance level the total number of participants should be 100 with at least 50 participants

included in each of the two conditions. Although only a total number of 96 participants completed the experiment it was deemed appropriate for pilot study purposes.

**Participants and Procedures**

Undergraduates ($N$ = 96; 57 female, 35 male, 4 missing) enrolled in Communication Studies courses at Louisiana State University reported $M_{age}$ of 21.80 ($SD$ = 3.94) and were primarily Caucasian ($n$ = 54). Although recruited from CMST courses, 11 different major areas of study were represented. A small amount of course credit (1.5% of course grade) was awarded for participation. Students were presented informed consent before their participation and all experimental procedures detailed in this manuscript were approved by the LSU Institutional Review Board for human subjects (see Appendix H). Participants were required to complete both parts of the study for credit.

First, students completed the Highly Sensitive Persons Scale (HSPS; Aron & Aron, 1997) as well as basic demographic information via a common online survey system. Second, students utilized a research participation system to register for an experiment time slot at their convenience. Students then reported to a computer laboratory in order to complete the Diagnostic Analysis of Nonverbal Accuracy-2 (DANVA-2; Nowicki & Duke, 1994). Only one student was allowed per 30-minute timeslot to prevent any cross-contamination.

When a student arrived at the laboratory, which was a new computer lab with approximately 11 computers at individual carousels, it was determined if he/she had completed the online section first. If not, students were asked to complete the self-report surveys and subsequently reschedule their appointment for the experiment portion. Given completion of the online survey, the student was randomly assigned to one of two stimulus modes, audio ($n$ = 48) or visual ($n$ = 48), and instructed to complete three separate parts of the DANVA-2: the postures

test (POS), the facial recognition test (AF), and the paralanguage test (AP). Each participant was randomly assigned to a sequence of tests (e.g., POS, AP, AF; AP, POS, AF; etc.) to prevent any possible sequencing effects (Rohsenow & Niaura, 1999). Per Latin square design standards, an equivalent number of students participated in all six sequences ($n$ = 16). Participants were instructed to wear a pair of headphones at each station regardless of the testing condition (i.e., visual or audio), and were briefed on the procedures for completing the accuracy tests as well as the corresponding manipulation checks.

Several manipulations were used including the source of stimulation and the intensity of stimulation. For the audio condition, varying degrees of static were played through the headphones. In the control group no static was present, whereas the moderate condition consisted of playing static for short durations at random intervals, and the high stimulation condition played static constantly. For the visual manipulation computer carousels were either plain (control group) or they were surrounded with varying amounts of full page M.C. Escher drawings.[1] This type of stimulation was chosen because highly sensitive persons are believed to "notice and enjoy" works of art (Aron, 1996, p. xxii). Escher's drawings are attractive, provocative, and elaborate, all noted characteristics of visual stimuli that engage highly sensitive persons (Aron, 1996). In the moderate condition only one image was prominently displayed near the computer monitor, while for the high stimulation the majority of the carousel was covered with ten different images.

Participants were exposed to each of the three levels of stimulation while completing three independent, unrelated computer activities. After completion of each diversion task, students responded to manipulation check questions regarding their level of audio, visual, and

[1] Although copyright permission from the artist was sought, no allowances for publication were granted for this research project. To view sample images, visit the website of M.C. Escher at, http://www.mcescher.com/.

processing distraction at the corresponding level of intensity. The order of the items was randomized. After finishing all three activities and all three sets of manipulation check questions, students were thanked for their participation and assigned research credit.

**Measures**

**Highly Sensitive Persons Scale.** The Highly Sensitive Persons Scale (Aron & Aron, 1997) was originally developed for participants to respond to 27 *True-False* statements regarding their sensitivity. This scale was modified from the original forced-choice response format to a more conventional 7-point Likert scoring, and was shortened to 18-items following recommendations of Smolewska, McCabe, and Woody (2006). Higher scores indicate higher levels of sensory-processing sensitivity. For group assignment and analysis purposes the unidimensional factor structure of the HSPS will be evaluated.

Confirmatory factor analysis (CFA) was conducted utilizing Amos 18.0. Commonly used fit indices and comparison thresholds were used to evaluate all CFA fit statistics, including the comparative fit index (CFI) above .90, the standardized root mean square residual (SRMR) below .10 and the root mean square error of approximation (RMSEA) below .08. Standardized residual covariance matrices were inspected for values greater than two in absolute value. Specifics related to these statistics are found in an assortment of different sources (e.g., Byrne, 2010; Hoyle, 2000; Hu & Bentler, 1999; Kline, 2005; Raykov & Marcoulides, 2006).

For the unidimensional structure of the HSPS measure, fit statistics, $\chi 2$ (324) = 678.028, $p < .001$, SRMR = .102, CFI = .66, RMSEA = .107 (90% CI: .096, .119), initially indicated a poor fitting model. Further inspection of covariance matrices suggested the removal of 7 items. After removal, fit statistics, $\chi 2$ (44) = 86.57, $p < .001$, SRMR = .08, CFI = .90, RMSEA = .10 (90% CI: .07 .13), indicated an adequate fitting model. Although RMSEA estimates surpassed

the upper bound of recommended fit statistics, no standardized residual covariance values were above 1.70, and MacCallum et al. (1996) suggest .10 as a mediocre fit. A total scale score was computed by averaging items; internal consistency estimates, means, and standard deviations are presented along with items in Table AA.1.

Table AA.1: Items and statistics for the HSPS

| **HSPS** | *Λ* | *S.E.* | |
|---|---|---|---|
| Do you startle easily? | .52 | .35 | |
| Are you annoyed when people try to get you to do too many things at once? | .49 | .25 | |
| Do changes in your life shake you up? | .58 | .22 | |
| Do you find it unpleasant to have a lot going on at once? | .61 | .24 | |
| When you must compete or be observed while performing a task, do you become so nervous or shaky that you do much worse than you would otherwise? | .56 | .34 | |
| Do you seem to be aware of subtleties in your environment? | .26 | .23 | |
| Do you find yourself needing to withdraw during busy days, into bed or into a darkened room or any place where you can have some privacy and relief from stimulation? | .52 | .33 | |
| Are you easily overwhelmed by things like bright lights, strong smells, coarse fabrics, or sirens close by? | .86 | .15 | |
| Are you made uncomfortable by loud noises? | .82 | .19 | |
| Do you become unpleasantly aroused when a lot is going on around you? | .66 | .22 | |
| Are you bothered by intense stimuli, like loud noises or chaotic scenes? | .83 | .19 | |
| | *M* | *SD* | *α* |
| **TOTAL SCALE** | **3.79** | **1.11** | **.88** |

For group membership and analysis purposes, total scores were dichotomized according to population percentages suggested by Aron and Aron (1997) such that approximately the highest 20% of student HSPS scores were classified as "highly sensitive". In these data, the highly sensitive group was comprised of students who averaged equal to or above 4.5 (on a seven-point scale) on the HSPS measure. A total of 21 highly sensitive persons were identified as highly sensitive and were distributed almost equally between stimulation conditions.

Table AA.2: Sample sizes by sensitivity and stimulation condition

| | VISUAL | AUDIO |
|---|---|---|
| HSP | 10 | 11 |
| Non-HSP | 38 | 37 |

**Distraction.** Three scales comprised of four items each were used to measure 1) being distracted by audio in the environment, 2) amount of visual distraction, and 3) the amount of attention afforded to thinking about the comforts of the room. In total, 9 different scores were created for each participant according to the three sets of manipulation checks (audio, visual, processing) at each of the three levels of stimulation (low, moderate, high). Reliability estimates concerning the manipulation check scales are presented in Table AA.3 along with means and standard deviations. Three estimates of internal consistency were below .70, all of which occurred in the no-stimulation condition suggesting that greater variability in distraction scores was presented in the control conditions. For instance, no subscales of audio distraction showed adequate internal consistency estimates in the control condition; however, because reliabilities were adequate in all other conditions, especially in the moderate and high intensity conditions in the audio stimulation group ($\alpha \geq .90$), the measure can still be considered appropriate. For pilot study purposes, the low reliability of the no-stimulation audio distraction scale should not present a problem. All items for the manipulation checks were created exclusively for this study and with the study procedures in mind and are located in Table AA.4.

Table AA.3: Distraction measure reliabilities and means by stimulation type

| Condition | Low Stim α | *M* | *SD* | Mod Stim α | *M* | *SD* | High Stim α | *M* | *SD* |
|---|---|---|---|---|---|---|---|---|---|
| VISUAL | | | | | | | | | |
| Visual | .74 | 1.12 | .38 | .87 | 1.18 | .51 | .86 | 1.27 | .62 |
| Audio | .58 | 1.42 | .63 | .79 | 1.23 | .54 | .70 | 1.19 | .41 |
| Processing | .63 | 1.25 | .51 | .66 | 1.20 | .42 | .84 | 1.36 | .68 |
| AUDIO | | | | | | | | | |
| Visual | .90 | 1.24 | .61 | .91 | 1.31 | .67 | .88 | 1.45 | .78 |
| Audio | .61 | 1.38 | .54 | .90 | 2.06 | 1.24 | .93 | 2.90 | 1.48 |
| Processing | .74 | 1.40 | .71 | .81 | 1.63 | .91 | .80 | 2.12 | 1.16 |

Table AA.4: Items for manipulation checks

| Item |
|---|
| **Visual** |
| I had difficulty concentrating on the survey because I was thinking about sights around me. |
| I found myself thinking about the sights of the room. |
| I found myself to be bothered by the sights of the room. |
| While taking the previous section I was distracted at times by something I could see in the room. |
| **Audio** |
| I found myself thinking about other sounds besides the verbal instructions. |
| I found myself to be bothered by sounds I heard. |
| I found myself thinking about the sounds I was hearing other than the task instructions. |
| While completing the previous section, I recall taking note of the sounds around me. |
| **Processing** |
| Something other than the task at hand got my attention while taking the previous section. |
| I found myself thinking about distractions in the room. |
| I remember thinking about ways to become more comfortable by changing the sights in the room. |
| I found myself concentrating on sights and sounds around me. |

**Results: RQ1**

It is first important to establish that the various stimulations and conditions introduced to the subjects were appropriately perceived. Namely, the control condition (no stimulation

introduced) should produce the lowest distraction scores and the high stimulation condition should produce the highest distraction scores with the moderate condition serving as a midpoint in-between. In order to determine which of the manipulations, audio or visual, was perceived more appropriately by the subjects, in SPSS 19.0 a repeated measures ANOVA analysis was performed. This analysis utilized distraction scores on each of the three stimulation conditions as the within-subjects factor and the two stimulation types as the between-subjects factor. Three separate tests were performed for each of the measures of distraction (visual, audio, and processing), and scree plots for each of the conditions and their relevant distraction scores are presented in Figures AA.1 (visual) and AA.2 (audio).

When investigating visual distraction scores in the visual stimulation condition, Mauchly's test indicated that the assumption of sphericity had been violated $X^2$ (2) = 7.44, $p <$ .05, therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .87$). Results failed to identify a significant main effect, $F$ (1.74, 81.78) = 1.71, $p$ = .19, for visual stimulation intensity on visual distraction scores. Although the plot seems to suggest a linear pattern of distraction, the variance in distraction scores was not equivalent between levels of intensity and as such the visual manipulation did not properly prime the subjects as presumed. The mean difference, $M_{diff}$, between distraction scores in the control ($M$ = 1.18; $SD$ = .51) and high stimulation control ($M$ = 1.36; $SD$ = .71) conditions was only +.18. These findings indicate that the visual manipulations were not assessed by the participants as hypothesized. It appears they were all assessed similarly, thus, they will not be discussed further.

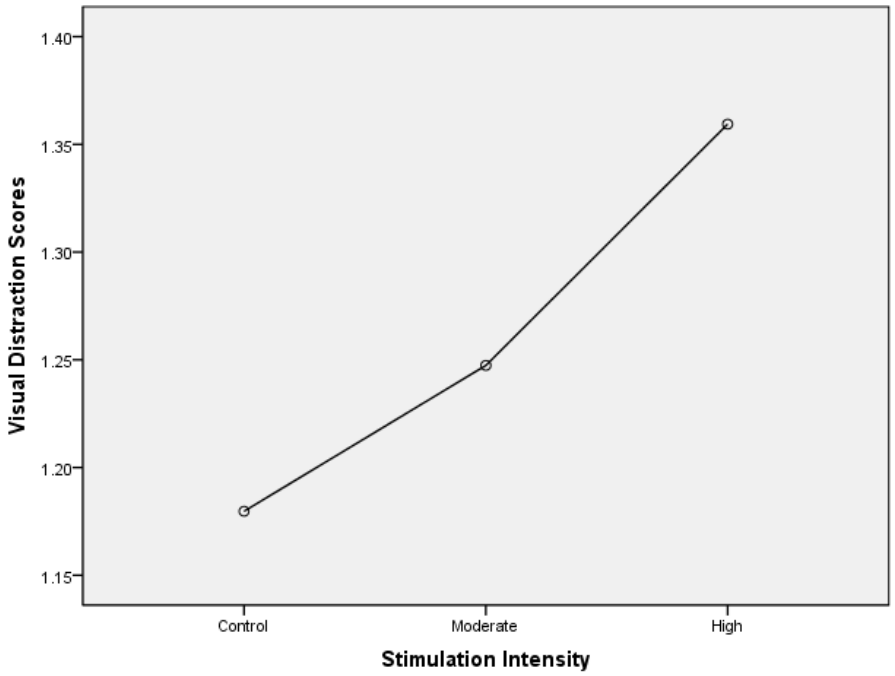



Figure AA.1: Repeated measures ANOVA, visual distraction scores by intensity

When investigating audio distraction scores in the audio stimulation condition, Mauchly's test indicated that the assumption of sphericity had not been violated $X^2$ (2) = 2.99, $p$ = .14. The results show that there was a significant main effect for which distraction demonstrated variability across stimulation intensities, $F$ (2, 94) = 31.23, $p$ < .001. Inspection of means (see Table AA.5) indicates that the manipulations were assessed by the participants as hypothesized: distraction scores were the lowest for the control condition (no audio stimulation) and were highest for the high stimulation (heavy static) condition with the moderate condition (intermittent static) seemingly as a mid-point. See Figure AA.2 for a graphic representation.

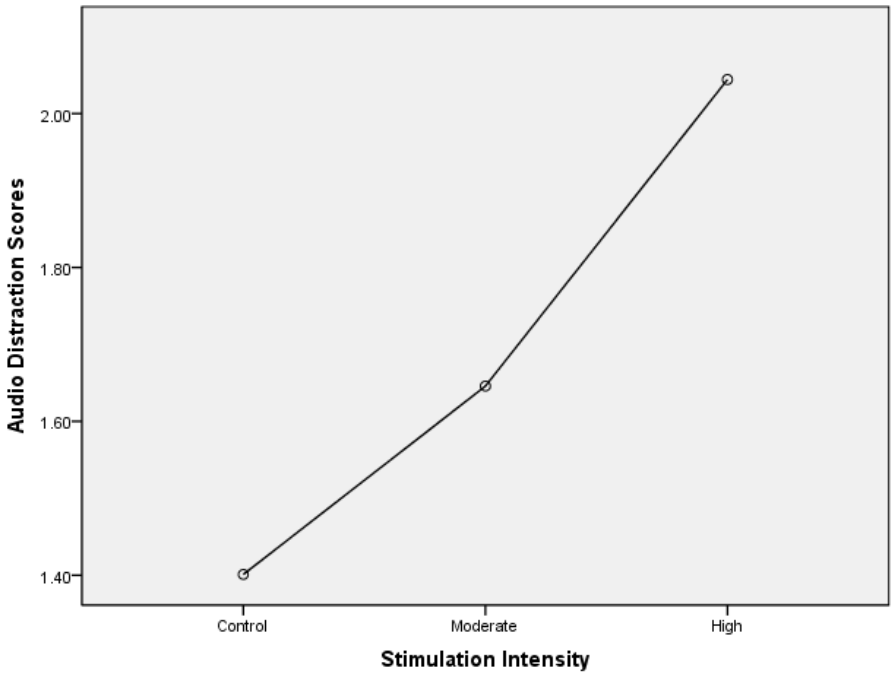



Figure AA.2: Repeated measures ANOVA, audio distraction scores by intensity

Next, post-hoc paired-samples t-tests of the audio distraction scores in the audio condition were investigated to confirm that differences between various levels of stimulation intensity were statistically significant. Examinations of mean differences were conducted between the control condition and the moderate condition, between the moderate condition and the high condition, and between the high condition and the control condition. Reports of paired-samples t-tests are reported in Table AA.5. All paired-sample t-tests were statistically significant (irrespective of *a priori* alpha level) indicating differences in audio distraction scores between the three levels of audio stimulation intensity.

Table AA.5: Paired-samples t-tests, audio distraction scores in the audio condition

| **Audio Condition** | | | | |
|---|---|---|---|---|
| | *Mean Diff* | *SD* | *t* | *Sig.* |
| **1 – 2** | .68 | 1.21 | 3.89 | < .001 |
| **2 – 3** | .84 | 1.26 | 4.62 | < .001 |
| **1 – 3** | 1.52 | 1.51 | 6.95 | < .001 |

Note: 1 = Control; 2 = Moderate stimulation; 3 = High stimulation
Mean differences represented how much greater the second listed condition is than the first. For example, a mean difference of .68 in the first cell indicates that the Moderate stimulation condition (2) was .68 units greater than the Control condition (1).

**RQ2**

A series of statistical tests were performed in order to determine if audio stimulation was assessed differently by HSPs and non-HSPs. First, a general linear model utilizing an ANOVA repeated measures design was tested with level of stimulation intensity as the within-subjects factor plus the dichotomized variable of sensory-processing sensitivity and audio distraction intensity as the between-subjects factors. The scree plot for the model is presented in Figure AA.3. Mauchly's test indicated that the assumption of sphericity had not been violated $X^2$ (2) = 3.93, $p$ = .14. The results show that there was not a significant interaction effect for level of stimulation intensity and being highly sensitive, $F$ (2, 94) = .66, $p$ = .52. These findings indicate that there was no significant interaction effect of sensory-processing sensitivity on level of stimulation intensity.

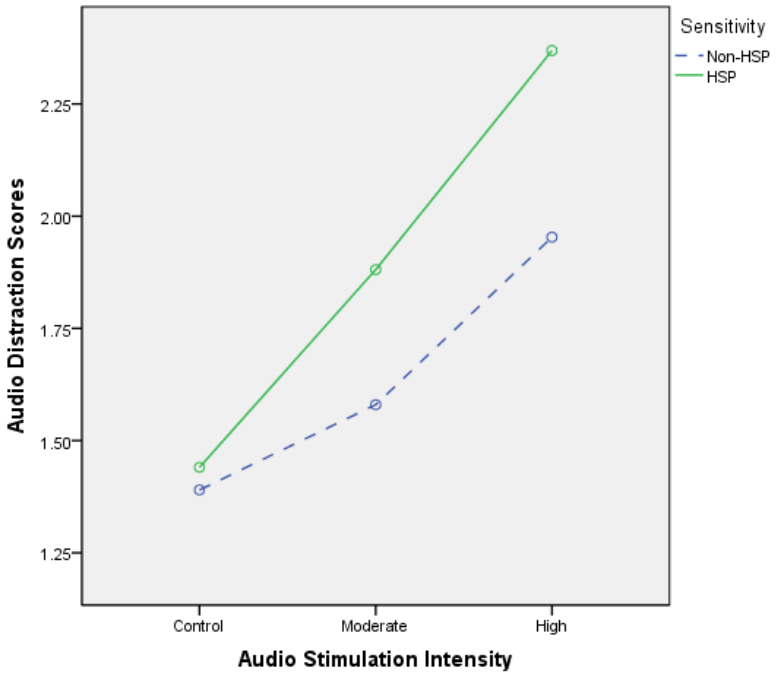



Figure AA.3: Repeated Measures test, audio distraction by sensitivity and stimulation intensity

Next, post-hoc paired-samples t-tests of the audio distraction scores in the audio condition were investigated to confirm that differences between various levels of stimulation intensity were statistically significant for both HSPs and non-HSPs. Examinations of mean differences were conducted between the control condition and the moderate condition, between the moderate condition and the high condition, and between the high condition and the control condition. Tests for both the highly sensitive and the non-sensitive are reported in Table AA.6. Of import in this table is that the magnitude of difference between means on distraction scores in the low and moderate condition were nearly twice the magnitude for HSPs than non-HSPs, +.45.

It should also be noted that for HSPs the first contrast (between low and moderate stimulation) was just beyond acceptable significance levels. This result is likely a function of the low number of highly sensitive persons in the study, suggesting that the study is slightly underpowered to detect a significant effect with an $n = 11$. However, given an increase in the

sample size of HSPs a significant effect would likely be evident. Furthermore, while the two-way tests of significance failed to meet conventional standards for significance, the nature of the hypothesis allows for one-tail significance testing which surpasses acceptable .05 criteria.

Table AA.6: Paired-samples t-tests, audio distractions scores in the audio condition by sensitivity

| **Audio Condition** | | | | |
|---|---|---|---|---|
| Non-HSP ($N$ = 37) | *Mean Diff* | *SD* | *t* | *Sig.* |
| **1 – 2** | .57 | 1.06 | 3.29 | < .01 |
| **2 – 3** | .83 | 1.28 | 3.91 | < .001 |
| **1 – 3** | 1.40 | 1.54 | 5.54 | < .001 |
| HSP ($N$ = 11) | | | | |
| **1 – 2** | 1.02 | 1.61 | 2.11 | = .06 |
| **2 – 3** | .89 | 1.22 | 2.41 | < .05 |
| **1 – 3** | 1.91 | 1.42 | 4.46 | < . 01 |

Note: 1 = Control; 2 = Moderation stimulation; 3 = High stimulation
Mean differences represented how much greater the second listed condition is than the first. For example, a mean difference of .57 in the first cell indicates that the Moderate stimulation condition (2) was .57 units greater than the Control condition (1).

Finally, to compare scores between the highly sensitive and non-sensitive at each level of stimulation intensity, a series of independent samples t-tests were performed. Results in Table AA.7 indicate group differences in audio distraction scores were only statistically significant for the moderate level of stimulation intensity, $t$ (46) = -1.36, $p < .05$, $r^2 = .20$. That is to say HSPs reported being significantly more distracted by moderate audio stimulation than did non-sensitive persons. No significant group differences were evident in the low and high audio stimulation conditions. Despite the absence of statistically significant differences at all levels of stimulation, a cursory examination of the data in Table AA.7 and the graphical representation in Figure AA.3 seem to suggest that highly sensitive persons are more distracted than their non-sensitive counterparts.

Table AA.7: Means, audio distraction scores by sensitivity and condition

| | Highly Sensitive ($n$ = 11) | | Non-Sensitives ($n$ = 37) | |
|---|---|---|---|---|
| **Situation** | ***M*** | ***SD*** | ***M*** | ***SD*** |
| **Audio ($N$ = 48)** | | | | |
| None | 1.47 | .65 | 1.35 | .52 |
| Moderate* | 2.50 | 1.57 | 1.93 | 1.12 |
| High | 3.39 | 1.44 | 2.75 | 1.48 |

Notes: ***$p$ < .001; **$p$ < .01; *$p$ < .05.

## Discussion

Results of this pilot study indicated two important findings. First, the audio stimulation condition provides the best manipulation of distraction which is to say that level of audio stimulation intensity had a significant main effect on audio distraction scores. Results indicated that differences in distraction score means were sharper in the audio condition. Second, although paired-samples t-tests demonstrated more robust contrasts in the audio condition for non-sensitive persons, it does appear that the audio stimulation works effectively for both highly sensitive and non-sensitive groups.

One consideration of why the audio stimulus chosen for this study provided a better manipulation than the visual stimulus may be that a subject can be directly exposed to audio stimulation through headphones. When participants wear headphones they are presented with a stimulus that is inescapable and unavoidable since caution was taken to prohibit participants from adjusting or turning off the audio volume. On the other hand, the nature of the visual cues used in this experiment did not require or dictate that participants view the images although their prominent placement by the screen did engage some subjects. The linear pattern of results in Figure AA.1 do suggest the manipulation worked, however it was not as effective as the audio stimulus. It is possible that other visual stimulation cues may be more conspicuous, such as a

bright lamp pointed at the subject. Overall, audio stimulus used in this study offers the experimenter greater control over the manipulation than does the visual stimulus.

Finally, evidence was presented that supported the claim by Aron (1996) that highly sensitive persons are more bothered by "moderate" stimulation than are non-sensitives. It should be noted though that a scree plot depicted HSPs as reporting higher scores on audio distraction than non-sensitives across all stimulation intensities, however independent samples t-tests failed to identity statistically significant differences in the low and high stimulation condition. However, as suggested by Aron (1996), HSPs did report significantly higher audio distraction scores in the moderate audio stimulation condition. Overall, it appears that highly sensitive persons are more distracted by sources of audio stimulation, especially in conditions of moderate stimulation.

## Conclusion

Findings of this pilot study suggest that the audio stimuli utilized in this experiment provide a higher quality manipulation of stimulation, likely due to the greater amount of experimental control audio stimulation offers the researcher. In addition, preliminary support for claims regarding the effects of moderate stimulation on highly sensitive persons is demonstrated.

## APPENDIX B: INSTRUCTIONS FOR THE DANVA-2

Paralanguage Test Instructions:

The computer is going to play a series of recordings in which you will hear someone say the sentence: "I'm going out of the room now, but I'll be back later." Listen to the sentence and click on the screen if the person saying the sentence is happy, sad, angry, or fearful (scared). There are 24 sentences. Before each sentence is spoken, a number will be announced. You are to listen to the sentence that follows and click on the screen if that person is happy, sad, angry, or fearful. Here is the first sentence.

Postures Test Instructions:
You are going to view some pictures of people and respond how think they feel. There will be a black oval covering the people's faces, so you must look at their whole body to decide which emotion they are feeling. Your choices are happy, sad, angry, and fearful. Let's get started

Facial Expression Test Instructions:
You are going to see some peoples' faces and then respond how they feel. Click on the screen if they are happy, sad, angry, or fearful (scared). Let's start

## APPENDIX C: ITEMS REMOVED FROM SCALES USED IN STUDY 1

HSPS:
Items of the HSPS originally recommended to be removed (Smolewska, McCabe, & Woody, 2006):
Are you easily overwhelmed by strong sensory input;
Does your nervous system sometimes feel so frazzled that you have to get off by yourself;
Do you get rattled when you have a lot to do in a short amount of time;
Does being very hungry create a strong reaction in you, disrupting your concentration or mood;
Do you make it a high priority to arrange your life to avoid upsetting or overwhelming situations;
Do you try hard to avoid making mistakes or forgetting things;
When people are uncomfortable in a physical environment do you tend to know what needs to be done to make it more comfortable (like changing the lighting or the seating);
Are you particularly sensitive to the effects of caffeine;
Do you make a point to avoid violent movies and TV shows.

Additional items removed from the HSPS include:
Do you have a rich, complex inner life;
Are you deeply moved by the arts or music;
Are you conscientious;
Do you notice and enjoy delicate or fine scents, tastes, sounds, works of art;
Are you bothered by intense stimuli, like loud noises or chaotic scenes.

ADD Scale:
Items removed include:
It takes a lot of effort to get my schoolwork done;
I don't make much effort at my schoolwork.

Big Five:
Items removed include:
Is talkative;
Tends to find fault with others;
Is depressed, blue;
Is helpful and unselfish with others;
Can be somewhat careless;
Is curious about many different things;
Is full of energy;
Can be tense;
Generates a lot of enthusiasm;
Has an active imagination;
Tends to be lazy;
Tends to be disorganized;
Has an assertive personality;
Can be cold and aloof;
Can be moody;
Values artistic, aesthetic experiences;

Prefers work that is routine;
Is sometimes rude to others;
Makes plans and follows through with them;
Gets nervous easily;
Has few artistic interests;
Likes to cooperate with others;
Is easily distracted.

## APPENDIX D: HISTOGRAM OF SENSORY-PROCESSING SCORES

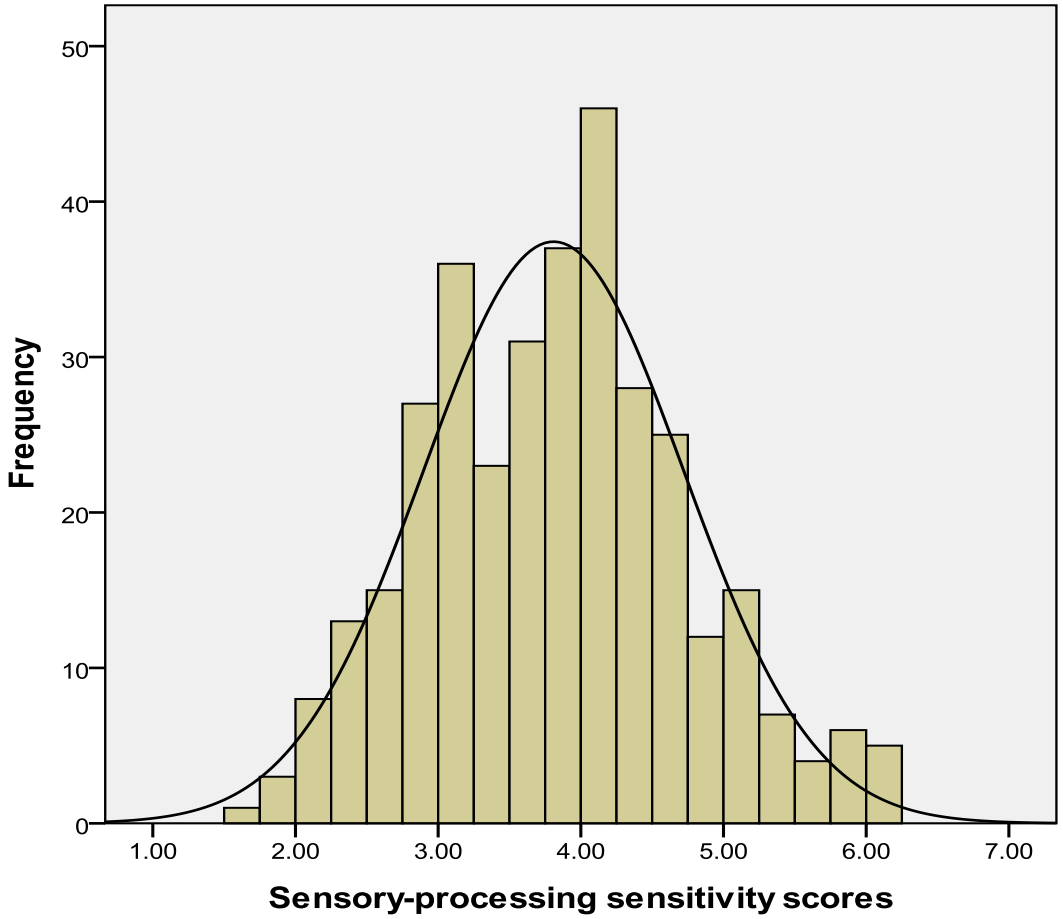



Figure AD.1: Histogram of sensory-processing sensitivity scores

## APPENDIX E: ANOVA, SENSITIVITY BY CONDITION ON AUDIO DISTRACTION SCORES

Independent samples t-tests failed to indicate any significant group differences in audio distraction scores for either moderate, $t$ (98) = .99, $p$ = .17, $r^2$ = .10, or high, $t$ (98) = 1.11, $p$ = .35, $r^2$ = .11, stimulation. Means are presented in Table AE.1. This suggests that HSPs reported equivalent distraction scores as non-HSPs in both treatment conditions.

A univariate ANOVA test was performed with sensitivity and condition as independent variables and audio distraction scores as the dependent variable to visually inspect mean differences. Like results of the manipulation check, ANOVA tests again indicated a significant effect for condition, $F$ (1, 342) = 19.82, $p < .001$, although there was no significant main effect for sensitivity, $F$ (1, 342) = 3.38, $p$ = .07, and no interaction effect between sensitivity and condition, $F$ (1, 342) = .01, $p$ = .99. Overall, however, plots of mean audio distraction scores indicated that highly sensitive persons reported higher distraction scores across all three stimulation conditions (see Figure AE.1), yet these differences were not statistically significant. Thus, highly sensitive persons and non-sensitive persons reported statistically equivalent levels of distraction across all stimulation conditions, however means plot reflected the proposed difference. The results indicate that the treatment was assessed similarly by HSPs and non-HSPs.

Table AE.1: Means, audio distraction scores by sensitivity and condition

| | HSP *M* (*SD*) | Non-HSP *M* (*SD*) |
|---|---|---|
| Control Condition | 2.03 (1.01) | 1.79 (.87) |
| Moderate Condition | 2.69 (1.35) | 2.41 (1.24) |
| High Condition | 3.15 (1.56) | 2.87 (1.15) |

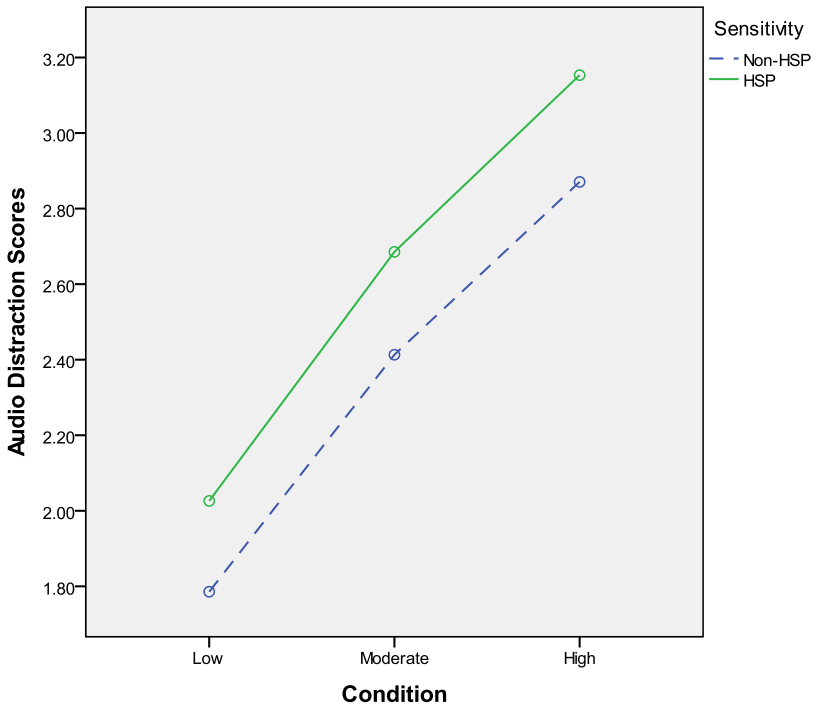



Figure AE.1: ANOVA, stimulation condition by sensitivity on audio distraction scores

## APPENDIX F: EMAIL TO RELATIONAL PARNTERS

Dear «Full_Name_of_Partner»:

You have been asked by «What_is_your_full_name_for_research_cr», a student enrolled in a Communication Studies course at Louisiana State University, to assist them in the completion of a research study. With your help, this student will earn participation credit that is an integral portion of their class credit.

Please complete the brief online survey, accessible here:

https://www.surveymonkey.com/s/R2CHHS8

This survey should take you around 10 minutes to complete. Your answers will be kept confidential and will NOT be shared with the participating student. Please complete this survey as soon as you are able, so the student can be granted their research credits.

In the survey, we will ask for your contact information. We will only contact you in case we have questions or to confirm that it was you who completed this survey. This information will not be sold, transferred, or made public at any time. All information that you provide us will remain confidential. After matching your name in our records and granting the student credit, your information will be deleted to ensure confidentiality.

We appreciate your willingness to assist this student. Should you have any further questions, please reply to this email and I will answer them.

Thank you in advance for your assistance,

Christopher Charles Gearhart, M. A.
Researcher, Communication Studies Department
Louisiana State University

## APPENDIX G: ITEMS REMOVED FROM SCALES IN STUDY 2

GRCS:
Items removed include:
Moving up the career ladder is important to me;
I sometimes define my personal value by my career success;
I evaluate other people's value by their level of achievement and success;
I worry about failing and how it affects my doing well as a man;
Doing well all the time is important to me; I strive to be more successful than others;
I am often concerned about how others evaluate my performance at work or school;
I feel torn between my hectic work schedule and caring for my health;
Finding time to relax is difficult for me;
My needs to work or study keep me from my family or leisure more than I would like;
Expressing feelings makes me feel open to attack by other people;
Telling others of my strong feelings is not part of my sexual behavior;
Verbally expressing my love to another man is difficult for me;
Expressing my emotions to other men is risky.

CMNI:
Items removed include:
In general, I do not like risky situations;
It would be awful if someone thought I was gay;
I like to talk about my feelings;
I would feel good if I had many sexual partners;
It is important to me that people think I am heterosexual;
I believe that violence is never justified;
Sometimes violent action is necessary;
I don't like giving all my attention to work;
More often than not, losing does not bother me;
I never do things to be an important person; and, I enjoy taking risks.

MADS:
Items removed include:
When my partner is angry at me, he tells me;
When he is disappointed in me, he tells me;
He offers constructive alternatives for bothersome behavior;
Knowing how I feel is important to my partner;
My partner helps me to understand what he is saying;
My partner verbally communicates to me that he understands and values my position;
My partner shows interest in my activities;
My partner gives me emotional support;
When I have a complaint, my partner tries to understand;
My partner tries to understand my complaints;
My partner tells me when he is feeling proud of himself;
My partner tells me how he feels about things;
My partner tells me when he's proud of me;

My partner tells me when he's happy;
My partner tells me when he's pleased with me;
I wish my partner was more affectionate;
When conflicts get out of hand, my partner usually tries to stop them and ask if we can set up another; time for discussion;
When conflicts get out of hand, my partner usually attempts to stop and talk at a later time;
When things get heated, my partner usually tries to stop and set up a time to discuss things later;
My partner will do favors for me, even when he's having a bad day;
My partner tries to phrase things positively;
My partner tells me when he's having a bad day;
When I make complaints, my partner makes complaints too;
When we drift off topic, my partner tries to get back on track;
When discussing a problem, my partner tries to focus on that one problem;
My partner takes more responsibility for staying on track during conflict;
When an issue arises, my partner asks me directly how I feel or think about it;
If my partner does not understand my point of view, he asks for elaboration;
My partner often feels unable to get out of heated arguments;
When discussing issues, my partner usually withdraws;
When discussing issues, my partner remains silent;
When problems arise, my partner often leaves the room;
My partner is comfortable with expression of affection;
My partner is affectionate toward me;
When we argue, my partner's negative feelings rise quickly;
When we argue, my partner loses his temper easily.

# APPENDIX H: LSU INSTITUTIONAL REVIEW BOARD APPROVAL

## Application for Exemption from Institutional Oversight

Unless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research/projects using living humans as subjects, or samples or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

Institutional Review Board
Dr. Robert Mathews, Chair
203 B-1 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.6792
irb@lsu.edu | lsu.edu/irb

- Applicant, Please fill out the application in its entirety and include the completed application as well as parts A-E, listed below, when submitting to the IRB. Once the application is completed, please submit two copies of the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at http://www.lsu.edu/irb/screeningmembers.shtml
- A Complete Application Includes All of the Following:

**(A)** Two copies of this completed form and two copies of parts B thru E.
**(B)** A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1 & 2)
**(C)** Copies of all instruments to be used.
- If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.

**(D)** The consent form that you will use in the study (see part 3 for more information.)
**(E)** Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB.
Training link: ( http://phrp.nihtraining.com/users/login.php.)

**1) Principal Investigator:** Christopher C. Gearhart **Rank:** PhD Candidate **Student*? Y/N** Y

**Dept.:** CMST **Ph:** 619.817.6501 **E-mail:** cgearh1@lsu.edu

**2) Co Investigator(s):** please include department, rank, phone and e-mail for each
* If student, please identify and name supervising professor in this space
Dr. Graham Bodie, CMST, Asst. Professor, 578.6683, gbodie@lsu.edu

**3) Project Title:** INFLUENCE OF SENSORY-PROCESSING SENSITIVITY ON COMMUNICATION SKILLS AND INTERPERSONAL RELATIONSHIPS

**4) LSU Proposal?(yes or no)** N **If Yes, LSU Proposal Number**

Also, if YES, either ○ **This application completely matches the scope of work in the grant**
**OR**
○ **More IRB Applications will be filed later**

**5) Subject pool** (e.g. Psychology Students) Communication Studies Students
- Circle any **"vulnerable populations" to be used**: (children <18; the mentally impaired, pregnant women, the aged, other). Projects with incarcerated persons cannot be exempted.

**6) PI Signature** _____ **** Date** 4/20/2011 (no per signatures)
****I certify my responses are accurate and complete**. If the project scope or design is later changed I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

IRB# _____ LSU Proposal# _____
☐ Complete Application
☐ Human Subjects Training

**Screening Committee Action**: Exempted ✓ Not Exempted ___ Category/Paragraph ___
**Reviewer** James Hongratt **Signature** James Hongratt **Date** 4/22/2011

# VITA

Christopher Charles Gearhart was the first child born to Dale and Jere' Gearhart in Fort Worth, Texas, where he was active in the media production club during high school and earned his black belt in the martial arts (with his mother).

He graduated with a Communication Studies major from the University of North Texas where he was an active member of the Phi Kappa Sigma fraternity and UNT football fanatic, as well as a proud owner of a beautiful dog named Madison (the "Mad Dog"). After spending some time living in Aguascalientes, Mexico, with his cousin in hopes of concreting his Spanish, Chris attended graduate school in San Diego, California, where he was turned on to statistics and graduated from San Diego State University with his Master of Arts in communication studies.

Looking for something new, he and Madison headed back across country to Miami to enjoy the rich international culture and flavor of South Florida. After working and spending weekends along South Beach for over a year, Chris felt unfulfilled and yearned for the excitement of teaching: the ebbs and flows in a semester, perennial enjoyment of meeting a new group of people, and being surrounded by educated minds.

Choosing Louisiana State University over other schools closer to family, Chris quickly experienced all the splendor of Louisiana, including the warm weather (and Hurricane Gustav, which hit his first month in Baton Rouge), the wonderful hospitality of the people including his neighbors Paul and Lisa, and the delectable Cajun cuisine namely dishes like gumbo and etouffee. With the help and support of his advisor, Dr. Graham Bodie, Chris has published several academic manuscripts, earned several Top Paper awards at the annual meeting of the National Communication Association, and will graduate with a Doctor of Philosophy degree in communication studies in May 2012.

Coast to coast, Chris and Madison have met countless great people, seen many beautiful places, and made innumerable memories.